LISBON UNIVERSITY - FACULTY OF ARCHITECTURE

PRODUCT DESIGN IN STUDIO

Design of rail collective transports, design of products and spaces

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MASTER IN PRODUCT DESIGN

Jury

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Abstract

The purpose of this document is to present the outcome of an internship under the Master in Product Design from FA - UL . The host organization for the internship was the MBD Design Agency in Paris, France. The projects presented in this document were performed in full time working schedule.

Considering the nature of the host agency, it is expected that the objects under study for this internship are mainly vehicles for public transport: train, metro, tram and interiors and their equipment, but also design of products and spaces. In the context of product design, the main tasks to carry out were: research trends around new projects; defining themes of inspiration for a particular project; creative research in order to create three or more proposals for different designs, including new development or update of existing designs considering customer feedback.

This internship is expected to provide and improve the candidate skills at a personal and professional level:

- From the personal side: develop new skills and competencies such as new creative and production processes, develop a critical and analytical thinking, enhance ability of verbal expression and appreciate a new culture in a new city;

- From the professional side: learn and apply design skills gained at university in a real working context, follow the development of a real product, develop and learn new competencies both at the software level, as management level and quality of work, but above all, to improve teamwork skills and overcome new design working challenges.

Through this personal and professional experience, the student should be able to apply to more job opportunities and have a better understanding of the desired career. It is also expected to learn a new language so that it can be used with ease on everyday life.

Key-words

Public transport, product design, design of spaces; design studios.

Resumo

Pretende-se com este documento apresentar o resultado de um estagio no âmbito do Mestrado em Design de Produto da FA-UL. A organização acolhedora para o estágio foi a agência MBD-Design em Paris, França. Os projectos presentes neste documento foram executados, num horário laboral de tempo-inteiro.

Tendo em consideração a natureza da agência acolhedora, prevê-se que os objectos em estudo para este estágio sejam sobretudo os veículos de transportes colectivos: comboio, metro e eléctrico e respectivos equipamentos interiores, mas também design de aparelhos industriais e domésticos, tais como componentes para aquecimento central e mobiliário de escritório. No âmbito do Design de produto, as principais tarefas que se espera vir a desenvolver neste estágio são: pesquisa de tendências em torno de novos projectos; definição de temas de inspiração para um determinado projeto, (por exemplo, um novo metro numa determinada cidade Singapura, Nova Delhi, entre outros); Pesquisa criativa, a fim de criar três ou mais propostas de design diferentes e desenvolvimento e actualização de um determinado projecto de design após a escolha e comentários do cliente.

Com este estágio pretende-se adquirir e melhorar competências a nível pessoal e profissional:

- A nível pessoal: desenvolver novas aptidões e competências, tais como novos processos criativos e processos de produção, desenvolver um pensamento crítico e analítico, melhorar capacidade de expressão verbal e apreciar uma nova cultura numa nova cidada;

- A nível profissional: aprender e aplicar competências de design ganhas na universidade, num contexto de trabalho real, acompanhar o desenvolvimento de um produto real; desenvolver e aprender novas competências, tanto a nível de software, como a nível de gestão e qualidade de trabalho, mas, acima de tudo para melhorar capacidades de trabalho em equipa e superar novos desafios de projecto em design.

A experiência pessoal e profissional adquirida deverá culminar em mais oportunidades de emprego e uma melhor compreensão da carreira desejada. Espera-se também a aprendizagem de uma nova língua de modo a poder ser usada com facilidade na vida diária.

Palavras-chave

Transportes públicos; Design de produto; Design de espaços; Estúdios de Design.

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1. Project Introduction

INTRODUCTION

This work follows on from an opportunity to do an internship in a design studio developing works of interest, this opportunity was harnessed to develop projects in 3 areas: Design of rail collective transports, design of products and design of spaces. Being the area of transports the one that best distinguishes the agency MBD Design, it was the main focus of this internship. Apart from the work created within these 3 areas of design, knowledge was developed:

1. To the studio functioning level, and team working: The way the studio is organized, how the tasks are distributed, the way in which the strengths of each team member is called upon and their understanding of how to deal with each element.

2. Concerning the aspects involving the design process: Data analysis; followed by the creative research,that is, inspiration and market research, field analysis (understanding the behaviour of people, their interaction with the objects and the environment) and concept development (design ideas, 3D modelling of the best concept(s) and rendering). The development phase wasn't be the main focus of this internship as it is the responsibility of the senior designers (for the development) and MBD Designs subcontractors (for the production), interns only provided support when needed (simple tasks such as 3D modelling and assistance in treatment of images in Photoshop). In these phases must be taken into account aspects such as the ecological footprint, materials and technologies, user study, among others.

3. Learn and apply the methods and processes used by the company whenever possible in a teamwork environment.

In the end, the report will focus on the findings of the internship experience. The internship program which is articulated between the Faculty of Architecture - UL and the studio, was set during the internship according to the ongoing projects.

TITLE

Product Design in studio: Design of rail collective transports, design of products and spaces.

GENERAL OBJECTIVES

Understand and draw conclusions in terms of: **1.** The studio and team working; **2.** The aspects that engage the transports and product design; **3.** The methodologies and processes used in product development.

SPECIFIC OBJECTIVES

Within this internship it is intended to acquire and improve skills on a personal and professional level:

On a personal level: 1. New skills and competencies such as new creative and production processes; **2.** Develop a critical and analytical thinking; **3.** Improve capacity of speech; **4.** Enjoy a new culture in a new city (cultural development);

On a professional level: 1. Learn to apply skills gained during the studies, in the working world in a global context; **2.** Follow the development of a real product; **3.** Develop and learn new skills, in terms of software, management and work quality; **4.** Improving teamwork capabilities and overcoming challenges; **5.** More employment opportunities and comprehension of the desired career direction; **6.** Learning of a new language in order to be easily used in daily life; **7.** Dealing and learning from experienced designers.

RESEARCH TOPIC

How does an international design studio work: working methods and processes and how is the approach to the Design of Transports, Products and Spaces.

2. State of art

PUBLIC TRANSPORT VEHICLES: TRAIN, METRO AND TRAM

Problematic and mobility context to solve:

In the beginning of the XXI century, there are more than 20 megacities. The global urbanization continues to grow, according to Bill Ford (2011), nowadays there are around 800 million cars, in 2044 there will be about 9 billion people, which means an increase to around 2 to 4 billion cars in 2050. This will lead to higher consumption of fossil fuels, more waste of raw materials and greater congestion in cities, creating difficulties to access essential goods such as food and health. The car has many advantages, especially in commodity and comfort, however, when compared with public transport vehicles and low power or motorless vehicles such as bicycles and scooters, this turns out to be disadvantageous to an economic, environmental and social level [1].

[1] Source: *A Future beyond traffic,* www.ted.com, Video, TED (consult. 7.1.13)

Some benefits from the use of a collective transport include: it costs less money; occupies less urban space; uses less energy (in proportion to the number of passengers carried), it is safer and provides mobility to any type of user.

Aspects to be considered for the Design of Transports

User: Each mean of mass transportation has its own characteristics depending on the type of route: short, medium and long. For short and medium distances there is the metro and the tram, for medium to long, there is the regional train, and for long there is the high-speed train (TGV). Each type, requires different features because users have different needs depending on traveling time.

Social Security and inclusiveness, are two important points to pay attention in a project of public transport vehicles . The issue of physical safety of passengers and driver, as well as security against others, is perhaps the topic that requires more work. Transportation must be secured by surveillance cameras, when access is only possible by the use of a door, as it makes it easier to guarantee payment of the passage. Validation of tickets should also be controlled, so it is safer when transactions are made near the driver. With some urban transports, such as the train, the driver goes in an isolated area which on one hand is safer for the driver, but, on other hand is a problem for

the passengers since they are largely isolated from the only present authority available on the transportation vehicle, leaving them quite unprotected. Some users will require special attention, access ramps, support for wheelchairs, more space for easier mobility, priority, among others. Any individual with a stroller, a temporary foot injury, or five shopping bags in hand, can be classified within this type of users.

Route: Short distances require less comfort than medium and long distances, so the shorter the route, the less upholstered the seats are. High-speed trains, because they are intended for longer trips, require greater privacy, comfort, lighting, and additional features such as a bar and a bathroom. All mass transports, whatever the distance they travel, must be well signposted for a quick understanding of the site's location and stop information.

Frequency: The user can be a frequent or occasional user, can travel in a group or individually, and will have different needs depending on age and physical typology.

Characterization and user requirements:

1. The student will often carry more weight than most users and sometimes, for a matter of necessity, could work or study during the journey time. This user is able to carry with him, and often use, electronic objects, therefore, on long trips will be advantageous to have access not only to power sources, but also to removable tables.

2. The worker usually carries less weight than students, unless out of service and carrying purchases or children for example, he is also able to carry technology, therefore, in case of longer trips, also needs a table and electricity.

3. The elder, is often a passenger with special needs. Generally, the elder has eye strain, walks slightly slower than younger people, has less physical strength, and needs more space, because he has more weight and needs more comfort, so it is harder to move around and stand up. The elder needs extra assistance such as handrails and sloping banks. This user is seen more in short distance journeys, since, due to age, he travels less and prefers to stay in his own city.

4. The tourist, is always an occasional user, from his point of view, but a frequent user from the driver's point of view, This occurs predominantly when in tourist cities such as Paris and Lisbon. The tourist most often speaks a different language, and will be unfamiliar with the public transport system of the visiting country, so he will likely ask questions to the driver or passengers, therefore it is important that the transport, as well as the stations are well signposted and include in several languages.

5. The driver, is a very important element of the journey, since most passenger safety depends on it. To perform his work, it is important to be awaken and alert, to have good visibility and to feel comfortable, this because he spends many hours in the same position.

Complementary areas associated with transports

Aspects to be considered: Designing for the transport industry doesn't only require transports but also many other elements linked to the traveling experience, this is to say: Ticket purchase, checking it, waiting for the transport, luggage recovery, and various others. These involve the development of other objects and spaces that will make this experience as pleasant and functional as possible, such as: waiting areas, shelters to protect from weather conditions, information points and areas to purchase the travel tickets.

These objects and spaces need to consider, just like the transport vehicles, the target user's necessities because the target is very diverse, so their needs change according to the type of user. People with reduced mobility or with disabilities will also have specific needs that will need to be considered. These areas need to be easily identified, have clear signage so they can be easily understood, they should be comfortable enough given their environment (for example waiting areas in a bus station will require less comfort than waiting areas in an airport), relaxing, potentially provide entertainment in order to "kill" time, and they need to answer to standard ergonomics.

Ecological footprint:

"Don't do things today that make tomorrow worse" (Shedroff, 2009) [2]

[2] Source: *Design is the problem: the future of design must be sustainable*

What is sustainable development?

The publication of *Our Common Future* in 1987 by the World Commission on Environment and Development, popularized the term sustainable development as a "type of development that would enable us to meet our present needs in ways that would not jeopardize the potential of future generations to meet their needs." [3]

[3] Source: Walker, 2006. *Sustainable by Design Explorations in Theory and Practice"*

The aim of sustainable design should be to design and build products, services and experiences in order to reduce the use of non-renewable resources, minimize environmental impacts and relate people with the natural environment (Almendra).[4]

[4] Source: teacher Rita Almendra theoretical lessons

From the most polluting to the least polluting, will be given some statistics data on the level of CO2 emissions in each of the different types of vehicles: All

petroleum vehicles emit more CO2 than the diesel ones; LP gas vehicles pollute slightly more than diesel, the natural gas releases less CO2 than diesel; after the natural gas, comes the hybrid vehicles; Finally, comes the electric vehicles with 0% of emissions. Trains not 100% electrical emit higher levels of CO2 that most vehicles, however taking into account the number of passengers that are carried, trains become the least polluting vehicles, just after the electric cars, bicycles and other non-motorized vehicles (the guardian, 2009) [5].

The society we live in is the most prosperous and dynamic of all times, however, has many flaws and one of them is the carbon footprint resulting from the way products, equipment and raw materials are generated and used . There are many things in our lives that are wasted and left behind (Alex Steffen, 2005) [6].

[5] Source: Emissions by transport type [in line] www.theguardian.com (consult. 10.10.13)

It was concluded that the ecological footprint of a Canadian is 4.8 hectares (about 220 by 220 meters). If all lived as a typical Canadian about 3 planets would be necessary to have all necessary materials and energy. Today, the ecological footprint of the world is at 1.2 planets. The faster the economy grows, the more the environment is polluted. It was thought that the digital age would lead to lighter and greener economy, but has resulted in exactly the opposite: "We're filling up the world with amazing devices and systems - on top of the natural and human ones that were already here" (Thackara, 2011) [7].

[6] Source: *The shareable future of cities*, Video, TED (consult. 8.10.13)

For example, it takes 1.7 pounds of material for the production of a 32 megabytes microship, 630 times the total mass of the microship in itself. In addition to material, expenses are 100 times more the weight of the chip in fossil fuels. The ecological footprint of computing is not limited to chips. Producing electronic components involve very intense material production processes and various natural elements are destroyed during the production of communication equipments. A laptop has a material waste of 4000 times more its original weight (Thackara, 2011).

[7] Source: *In the Bubble Designing in a Complex World* (introduction)

Excess of consumption has consequences not only in the scarcity of natural resources and ecosystem health, but also on human health and quality of life. The planet Earth, between 1970 and 2003, lost 30% of health quality. This global tendency suggests that natural ecosystems are deteriorating at a pace never seen in human history. The biocapacity of the earth, no longer keeps up with human consumption and there is the risk of shortages of essential goods. The more scarce are the resources, The more expensive they become, accentuating the economic crisis (Almendra). It should be noted, that businesses are aware of these factors, but the direction of thinking, oriented to generate wealth, makes them create products with short duration target dates, so that they are modified by new production/models. Already little is fixed and reused, since it is cheaper to purchase new.

The fuel price increases more and more each day, due to the required amount and quantity available, worries about future supplies increase. Also, the growing ecological footprint and concerns with the same, lead the transportation industry, to recognize the need for change. In recent years the automotive industry has been investigating alternatives such as the use of hydrogen, biofuels and electric vehicles as replacements, because "Hybrid cars, which employ both an internal combustion engine and a electric motor to improve fuel efficiency and reduce emissions, are already a reality" (Fairs, 2009, p.154)[8].

The solar energy, also, is already being used and aspired by many designers. There is an annual event in Australia, the Worlds Panasonic Solar Challenge, which promotes the creation of new projects of photovoltaic vehicles (Fairs, 2009, p.155).

[8] Source: *Green design: creative sustainable design for the twenty-first century*

If we become aware of the ecological footprint left so far and start working all for the same purpose, future generations will enjoy a better quality of life. Imagine, green cities, without traffic, polluting cars left at cities entrances, residents using more means of public transport, bicycles, a life more in community. More cycle paths and streets cities without cars just for leisure , greater ease and accessibility to services and travel within cities, more people out in the streets having healthier and calmer life habits. All this is possible and can be observed in some cities: Reykjavik, Malmö, Vanouver, Copenhagen, Portland, San Francisco, Bahia de Caráquez, Sidney, Freiburg, among others.

One of the main factors that contributed to make this cities greener was the investment in renewable energies, means of public transport and bicycles (Caires, 2011)[9].

[9] Source: *10* cidades sustentáveis do mundo | oecocidades [in line]. URL http://www.ecocidades.com (consult. 2.1.13)

The design role

After all, environmental awareness has been growing and many companies already are managed by sustainability principles. For these companies the design is important, as it can modify the existing process behind the products and services as well as the resources used to manufacture and use. The efficiency of resources brings ecological and economical advantages and many companies have gained with these methods, since they reduce waste they also reduce the cost (Thackara, 2011).

> Internationally: Countries such as Denmark, Germany, the Netherlands, Austria, and Sweden are front-runners in impact assessment, design method development, and eco-design education. Their efforts contributed to an overall reduction of carbon dioxide emissions from EU manufacturing of over 11 percent between 1985 and 2000 (Thackara, 2011).

According to Nathan Shedroff (2009 p.289-300), we have to think about new

products and draws them sustainable, this requires: Designing parts that can be easily changed (and available in the market for replacement); make durable, impact-resistant; standardize components; create shapes that extend and adapt to various sizes (of people); create forms that can be redesigned; pay attention to maintenance, such as create light component sand create ways of changing them easily; draw classic styles rather than styles that are out of fashion quickly; work in team; project objects to be used for a long time; use pure materials to facilitate recycling; make parts that can be easily assembled and design objects that have life after its normal period of use.

Materials and production methods

A- Table of materials used in mass transportation 1

In the table below main existing materials in a mass transportation vehicle are identified. For each part of the vehicle, materials, their common applications (previous chart), advantages and costs are awarded.

VLT	materials class	common applications	advantages	cost
handrails, posts	metal	stainless steel (3)	very strong	high
windshields		aluminium	durable and lightweight	moderate to high
side windows	glass	laminated glass	very resistant, insulating	moderate
walls		tempered glass (2)	very safe	low to moderate
coatings	composites	fiber glass (FRP)	lightweight and durable	moderate
Seats and padding		thermoplastic composites (5)	lightweight and flexible	low to moderate
	textiles	synthetics	washable, hypoallergenic	under
	polymers	liquid-crystalline	fire resistant	low to moderate
		thermosetting (4)	lightweight,cheap maintenance	
		foams (6)	resilient, durable	
foldable bellows		synthetic rubber or thermoplastic rubber compounds (1)	resilient, durable, insulating	moderate

B- Table of materials used in mass transportation 2

In the table below main existing materials in a mass transportation vehicle are identified. For each part of the vehicle, material class, their common applications, manufacturing processes, finishings and the environmental impact of materials are awarded.

VLT	common applications	manufacturing processes	finishings	material environmental impact
handrails, posts	stainless steel (3)	bending of tubes and profiles stamping, extruding, forging, injection moulding	electroplating, spray painting, sanding, (electro) polishing, powder coating, electro deposition, galvanizing, sanding, cubic printing	recyclable
	aluminium	beating, super-forming, injected or sand casting, injection moulding, deep stamping	spray painting, powder coating, anodizing, electrodeposition, vacuum metallization, sanding, (electro) polishing, cubic printing	
windshields	laminated glass	lamination, curvature by mould and gravity	sanding, polishing, abrasive blasting, screen printing, dark film	very limited recycling
side windows	tempered glass (2)	tempering, optional chemical treatment curvature by mould and gravity		difficult recycling
walls	fiber glass (PRFV)	pultrusion, reaction injection moulding, lamination	spray painting, sanding, polishing	very limited recycling
coatings Seats and padding	thermoplastic composites (4 e 5)	thermoforming, injection moulding	flame retardants, cubic printing	difficult recycling
	synthetic textiles	extruded wiring	bleaching, dyeing, flame retardants, microbicidal agents	recyclable
	liquid-crystalline	thermoforming, vacuum casting	painting, sanding, polishing, screen printing, flame retardants	
	thermosetting (4)	reaction and injection moulding or by compression	painting, sanding, polishing, screen printing	very limited recycling
	foams (5)	reaction and injection moulding	flame retardants, microbicidal agents	recyclable
foldable bellows	synthetic rubbers or thermoplastic rubber compounds (1)	Compression moulding	flame retardants	variable cases

Materials life cycle:

A designer when develops a new project should consider the type of materials he will use, taking into account not only its price but also its environmental impact.

Metals: Firstly, when a deposit of metal ore is found, geologists and environmentalists need to investigate the site to make sure that no serious environmental damage will be caused (Studydoctor, 2010) [10]. The metal products are typically long lasting and have a higher perceived value than an equivalent plastic. However, extracting metals from their ores requires large expenditures of energy (Thompson, 2007, p.449) [11] and produces a lot of garbage and dangerous products (Studydoctor, 2010). The metals are extracted from ores in a oxireduction process: electrolysis or chemical reducing agents (carbon or hydrogen) remove the oxygen atoms of the metal atoms. The metal concentration in the ore varies, and the low concentration extractions are more polluting (Thompson,2007, p.453).

When an ore is extracted from the ground, has to be processed for impurities to be removed. This means that great deal of waste is produced during the process, some of which can be toxic and damage the local environment (Studydoctor, 2010).

How does the product after consumption should be eliminated? There are three hypotheses: discard the regular trash, and thus the metal will end up in the landfill, recycle, or reuse (Studydoctor, 2010). The economic value of the metal and the recycling efficiency (90% more energy efficient than raw materials extraction) allow that almost all scrap metal is recycled (Thompson,2007, p.453).

Unlike plastic, the metal retains its original strength when it is recycled. Therefore, it can be formed and recycled many times without any loss of quality (Thompson,2007, p.453).

Polymers: There have been many technological advances to reduce the sustainability of the plastic, such as the production of many disposable products made of bioplastics or thermoplastics with bioactive additives (Thompson, 2007, p.429).

Some plastics have however, a very negative environmental impact and not only in its production. They can take thousands of years to degrade, will pollute the atmosphere throughout its entire life cycle (Thompson, 2007, p.429)

When the polymeric products are not sent to the landfill, can be incinerated. This way, the heat produced can be used to generate electricity, although more atmospheric pollution is generated and more natural resources are wasted. For recycling, new natural resources are not used and energy is saved. However, cleaning and treating this products can be expensive. In addition, each time a plastic is recycled loses its characteristics (Studydoctor, 2010).

[10] Source: ***Lesson 12: Life cycle of metals***. URL. www.studydoctor.co.uk (consult. 12.1.14)

[11] Source: *Manufacturing Processes for Design Professionals*

The recycling of thermoplastics is very efficient, since there is a minimum quality degradation. Some products are made entirely of recyclable plastic material. It is then up to the designer to ensure that the plastic products can be dismantled and recycled, with a low level of contamination. For this, products must be designed with a single type of material, whenever possible (Thompson, 2007, p.429).

The plastics in end of life may also be taken to the landfill, however, they stay there forever without degradation (Studydoctor, 2010).

Glass: The glass used in the transportation industry is not a conventional 100% recyclable glass, like those used in many bottles. Indeed, production and recycling of these bottles (or other glass objects) are relatively simple, low cost and have a low environmental impact. In fact, tempered glass residues and the majority of the obsolete windshields are generally not recycled, and can not interfere with the recycling of the remaining glass. Its manufacturing process involves some common chemical treatment in addition, the laminated glass includes the application of an adhesive polymer film, that hinders the materials separation. Despite this, there are companies able to do it, however, the collection and the recycling costs are not economically viable, therefore the life cycle of these products ends up normally in the landfill. Another possible solution is to reuse these glass shards in "end-of-life" in artistic and community projects (Giacoppo, 2011).

Image 1. Synthesis of materials life cycle, 2013, Author: Sofia Malato

Vehicles life cycle: The purpose of an evaluation of the product life cycle is to expound in detail all the data on energy consumption, by products emissions and environmental impact generated during the vehicle production. Only with a study of all individual stages of these processes it is possible to evaluate and compare different vehicles and/or technologies. The values for the total inventory of the life cycle of a bus are calculated the same way as for cars, as both are road vehicles.

Buses are expected to have a useful life of 12 years. This deadline is due to the fact that after 12 years are eligible for parts replacement. Rail vehicles have a much longer life expectation than the buses.

The first step in the cycle is the development phase, when engineers decide which innovative technologies to use in the future vehicle, such as intelligent materials or motorization of efficient fuel consumption (Volkswagen, 2010 p.12) [12].

[12] Source: *The Life Cycle of a Car – Environmental Commendations Document Progress Volkswagen*. URL www.volkswagen.com (consult. 12.1.14)

The second step in the cycle is the manufacturing, or fabrication stage. Takes into account not only the manufacturing operations of vehicles, but also all operations that occur previously in the factories, such as the extraction of the raw materials and the production of those materials. Some of the extracted materials are processed to form steel and aluminium, from which the vehicle body and certain engine components will be made. Others are processed into plastic, glass and rubber. In all these stages energy is consumed, which also results in polluting emissions to the atmosphere. Energy in transportation, is also used, when such raw materials and components are sent by road and rail to the factory. However, the greatest contribution to the environmental impact of a vehicle lies in its lifetime, three times more than at the manufacturing stage. Thus, the minimization of fuel consumption of a vehicle is one of the most effective ways to reduce the carbon footprint (Volkswagen, 2010 p.12-14).

After fabrication and (legal) approval of the vehicle, it is launched in the market. This is the phase of service life. The durability of the vehicle will depend on the type of vehicle (car, bus, etc.), on the maintenance, and frequency of use. A public transport, in principle, will have a longer service life than a private car, and it is also more used and carries a greater number of people, so it produces less emissions compared to the pollution generated by cars. Finally the object reaches its end of life. This can end in several ways: is recycled component by component, reused or sent to the landfill. Most vehicle components may be reused, the process of Si-Con, co-developed by Volkswagen, is an example that ensures that the shredder residues, previously sent to landfill, are transformed into new raw materials. This process allows recycling of about 95% per vehicle in weight. Firstly, the vehicle in end of life is drained. Next, a variety of components that can be recycled and used in new products, such as the so-called secondary materials are removed. Parts that do not meet the minimum requirements for dismantling, or whose remanufacturing in spare parts is not profitable, are pounded (Volkswagen, 2010 p.15).

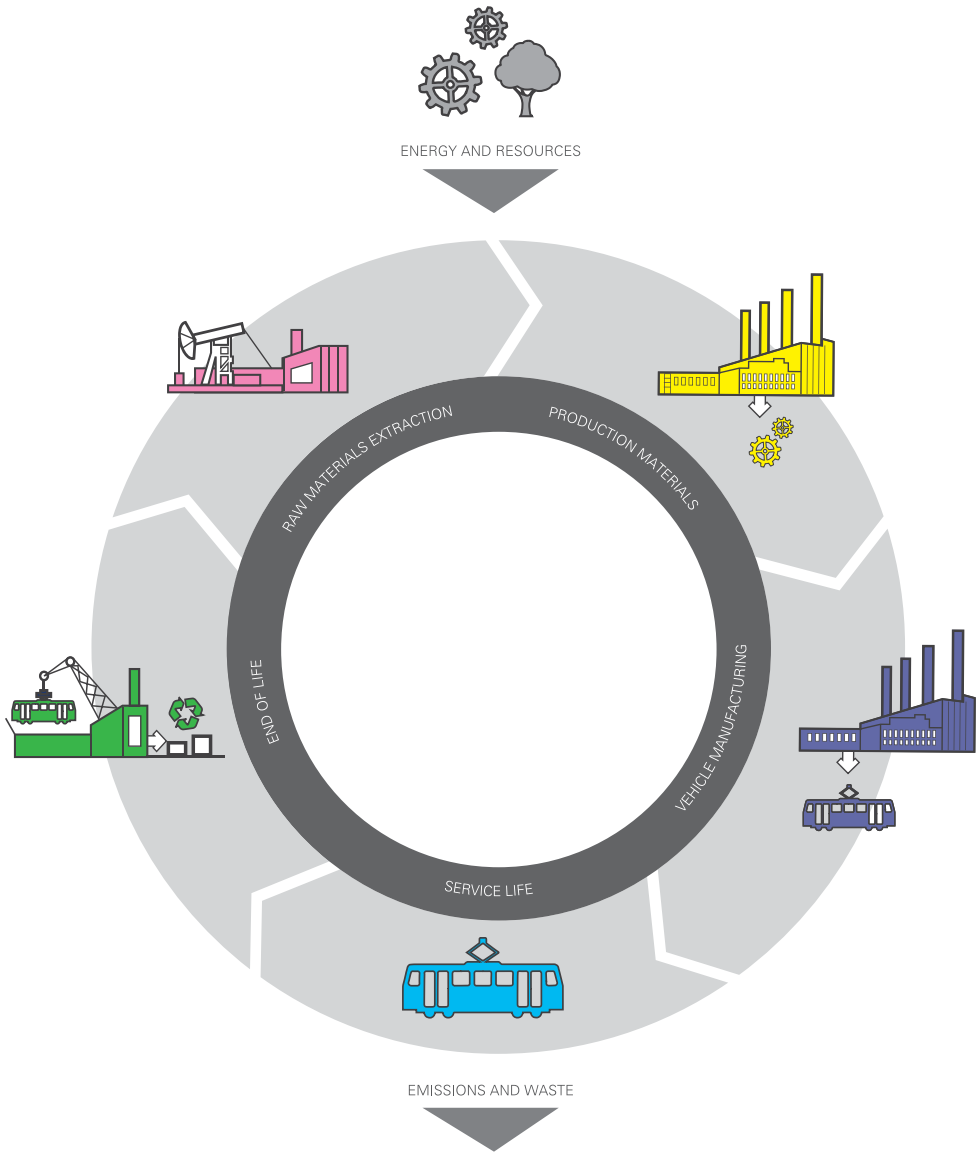


Image 2. Synthesis of vehicles life cycle, 2013, Author: Sofia Malato [13]

[13] Chart based on Volkswagen life cycle chart present in the document, *"The Life Cycle of a Car - Environmental Commendations Document Progress "*

Image 3. Materials used in a vehicle interior, 2013, Author: Sofia Malato

Benchmarking:

Interior and exterior design of collective transport vehicles:

- **Instant seat** *by Jose F. López*

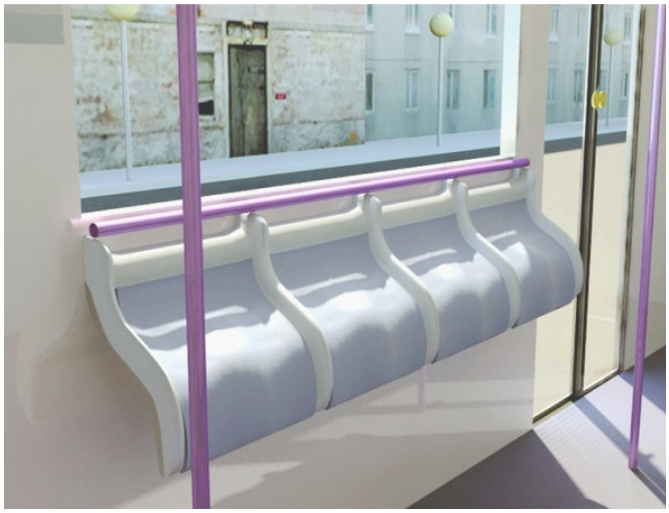


Image 4. Instant seat, 2012, Source: www.behance.net (consult. 13.1.14)

Seat to be used standing and leaning, ideal for short trips, has a surface that does not slip and is ergonomic (Lopez, 2012) [14].

[14] Source: Instant [in line]. www.behance.net (consult. 13.1.14)

- **ACBus** *by Ceren Bagatar*

Image 5. ACBus interior, 2010, Source: www.yankodesign.com/ (consult. 13.1.14)

Image 6. ACBus entrance, 2010, Source: www.yankodesign.com/ (consult. 13.1.14)

This project was designed to allow a practical crossing to any passenger with reduced mobility. It has many folding seats that give more interior mobility space. There is room for at least two wheelchairs, 4 baby carriages and for example, for users with eyestrain, the strong contrast across the bus facilitates identification. It also has a low floor and various supports (Bagatar, 2010) [15].

[15] Source: Big Open Love Bus [in line]. www.yankodesign.com (consult.13.1.14)

Pendolino *by Alstom*

Image 7. 2nd class view of the Pendolino to Switzerland, 2013, Source: www alstom.com (consult. 11.1.14), Author: Elena Cottini

Image 8. 1st class view of the Pendolino to Switzerland, 2013, Source: www alstom.com (consult. 11.1.14), Author: Elena Cottini

Image 9. Pendolino exterior in Itália, 2013, Source: www alstom.com (consult. 11.1.14), Author: C.Sasso

The new Alstom high speed train (TGV), the Pendolino, has a tilt system which makes possible to maintain speeds up to 250 km/h in curves (35% more than a conventional train) ensuring a perfect stability in curves. It is therefore also very comfortable, adapts to all types of weather, due to good insulation and air conditioning, is equipped with individual passenger information and entertainment systems (Alstom, 2013) [16].

The interior is sober and pleasant, in shades of gray and blue, the atmosphere is cosy, most seats are face to face (in pairs) with tables in the middle, the main difference between 1st and 2nd class is the space and the type of seat. The 2nd class coach has one more row of seats than the 1st class and the seats are simpler and less comfortable.

[16] Source: High-speed train Pendolino [in line]. www alstom.com (consult. 11.1.14).

- **X'Trapolis train** *by Alstom*

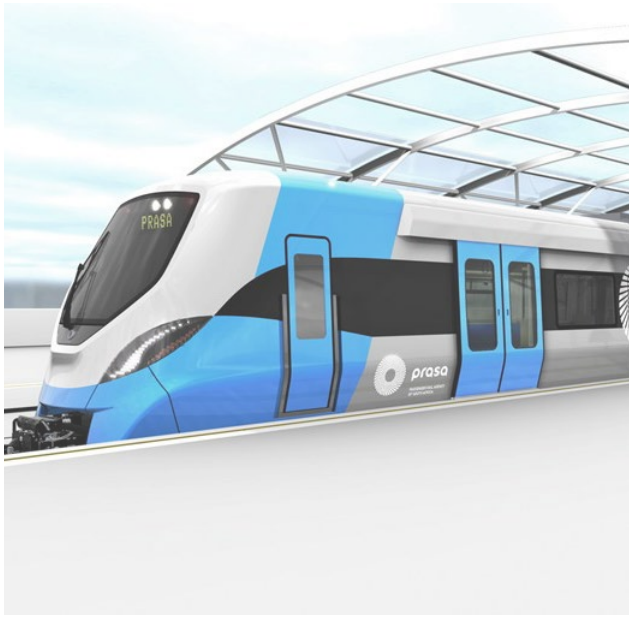


Image 10. X'Trapolis exterior, 2013, Source: Source: www alstom.com (consult. 11.1.14)

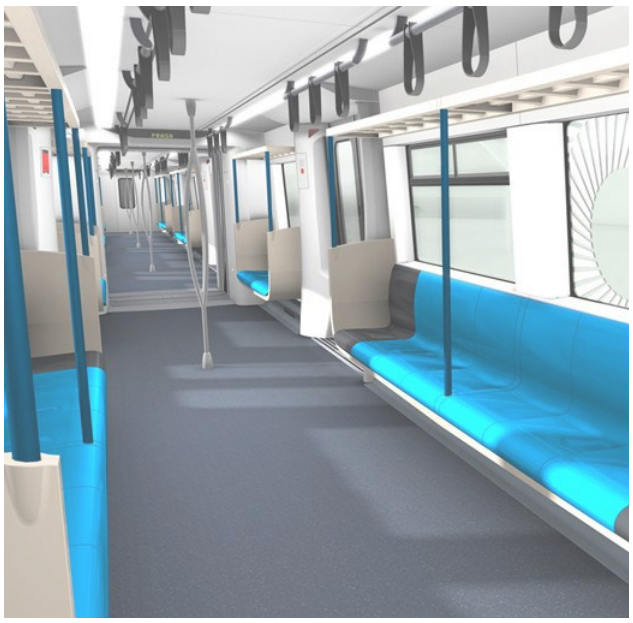


Image 11. X'Trapolis interior, 2013, Source: Source: www alstom.com (consult. 11.1.14)

X'Trapolis is aimed to people of the Su Africa, combines comfort and accessibility. Has a good circulation due to the interior space and number of doors to enter and exit (3 doors) which ensures a better movement during rush hours. Large windows improved inside visibility, giving passengers a greater feeling of security. It is equipped with modern interfaces and communication systems, ergonomic seats and areas for people with reduced mobility (Alstom, 2014) [17].

The metro is modular and has a modern design in shades of gray and blue, colours that are generally well accepted by the general public for being sober, discrete and calm.

[17] Source: Suburban train Xtrapolis [in line]. www.alstom.com/ (consult. 11.1.14).

Citadis T7 *by Alstom*

Image 12. Citadis T7 exterior 2013, Source: www.mbd-design.fr/ (consult. 11.1.14).

Image 13. Citadis T7 interior 2013, Source: www.alstom.com/ (consult. 11.1.14), Author: Yves Ronzier

On January 12, 2013, Alstom Transport presented the first of 19 Citadis trams for the T7 line. Citadis tram is 32 meters long and 2.40 meters wide and can accommodate more than 200 passengers (Alstom, 2013). To work on the new vehicles design, Alstom contacted MBD Design (MBD Design, 2013).

It is designed to offer better quality of life on board, has a high floor with platform, air conditioning, video surveillance and a system of passenger count, as well as a audio and visual information system. The seats are wider and the buttons to open the doors have better access to make traveling easyer for people with reduced mobility. Furthermore, Citadis is up to 98% recyclable and almost four times quieter than the motor traffic, (Alstom, 2013) [18].

The outer forms allow a natural blend of STIF gray and silver colours together with the RATP green (MBD Design, 2013) [19].

[18] Source: Suburban train Xtrapolis [in line]. www.alstom.com/ (consult. 11.1.14)

[19] Source: ALSTOM: Paris T7 and T8 tramways [in line]. www.mbd-design.fr/ (consult. 11.1.14)

- **Movia** *by Bombardier*

Image 14. Movia 2013, Source: www.bombardier.com

This automatic metro was developed by Bombardier for the Singapore Downtown Line (DTL). It is composed of high-capacity aluminum car bodies, developed from a standardized platform, ensuring a high degree of reliability, safety, low cost life cycle and are up to 90% recyclable. The Braking is regenerative and has an intelligent air conditioning to save energy. Moves at a maximum speed of 90 km/h and is about 70m long (3 carriages) (Bombardier, 2013) [20].

[20] Source: Our modern metros: helping cities breathe [in line]. www.bombardier.com (consult. 11.1.14).

- **Twindexx train** *by Bombardier*

Image 15. Twindexx exterior, 2010, Source: www.bombardier.com (consult. 11.1.14).

Image 16. Twindexx restaurant 2010, Source: www.designhaus-pm.de (consult. 12.1.14).

Twindexx is an electric intercity train with two floors, has a top speed of 200 km/h and about 200m long (8 carriages). It is very efficient and comfortable. Twindexx has a permanent magnetic motor, efficient cooling system and control system and power management, which reduces power consumption by 10%. It has easy access to all passengers (Bombardier, 2010).

The exterior design is futuristic in shades of red, gray, white and black. The interior is luxurious, respects the same tones and adds detail to the floor and wooden tables, wood not only gives an appearance of luxury and comfort, resembling to a dwelling. Some carriages have blue seats instead of red probably to differentiate classes. Twindexx also has a restaurant area.

- **Zefiro 380** *by Bombardier*

Image 17. Zefiro 380 exterior, Source: www.eng.fea.ru (consult. 13.1.14)

Image 18. Zefiro 380 interior, 2012, Source: futurnow.tumblr.com (consult. 11.1.14).

It is one of the fastest trains in the world travels at up to 380 kilometers per hour. Cutting-edge technologies and advanced aerodynamics reduce energy consumption and operating costs. This ultra-modern train also combines increased capacity of the segment with pioneering levels of passenger comfort (Bombardier, 2014).

ECO4 technologies that optimizes power consumption, reduces waste, reduces the emission of CO2 earning up to 50% efficiency. Better aerodynamic efficiency that brings more speed, safety and noise reduction. The Zefiro 380, offers 1,336 seats. It is one of the fastest mass production trains in the world, the lowest energy consumption per seat on high-speed trains trips. Offers much comfort to passengers and interiors are adaptable (Bombardier, 2014).

Complementary areas associated with transports:

- **Inspection and filtering posts** *by ADP*

Image 20. ADP inspection and filtering posts, 2011, Source: www.mbd-design.fr/ (consult. 15.9.14)

MBD Design won the contest launched by ADP (Paris Airports) for the design and the manufacturing of a functional prototype, that was installed in December 2011.

The design is creative and offers a warm and comfortable environment that reminds home. The different line components collide visually with each other taking into consideration even the floor around. This new design intends not only to give more comfort but also to improve security an speed up the inspection procedures. The light around not only creates a good environment but also gives guidance (MBD Design, 2011).

- **Osmose** *by Markc Aurel*

Image 21. Osmose bus stop, 2012, Source: www.designboom.com, Author: Metalco

Image 22. Osmose bus stop reading station, 2012, Source: www.designboom.com, Author: Metalco

Osmose is a programme launched in Paris (Gare de Lyon) by RATP (Parisian Public Transport Authority) during 6 months in 2012. RAPT is part of a extensive European project, European Bus System of the Future (EBSF), composed by 47 partners that share the same idea that, "transport spaces are not only for transport". The idea of this programme is to transform the conventional bus and metro stations, from a public space, into a living space. This new station is not only a waiting area, it offers as well a set of services such as: information via touch screens including the latest bus news and information about the area (cultural events, services offered, etc.); self-service library; mirror; sockets; wifi; snack area and electric bicycles. All of these services increase the passenger comfort and transform the usually "tedious" waiting experience in an enjoyable one (urban-obs, 2013).

[21] Source: Osmose: when public spaces become living spaces [in line]. urban-obs.com (consult. 30.11.14).

DESIGN OF PRODUCTS

(The products presented bellow are 2 of the main types of products developed by MBD Design lately. However, these products weren't studied during this internship, since the projects that would be selected for internship students were unpredictable. Anyhow, this chapter was kept due to its importance for the understanding of the host agency work.)

Problematic and context to solve

Office furniture

We live in a society faster than ever, workers work longer and longer hours due to competition and competitive environment. Global enterprises, continue to simplify and reduce installation and support services in offices to reduce costs (wtnnews, 2004) [22].

[22] Source: Are your working conditions better now - or worse? [in line]. http://wtnnews.com (consult. 12.1.14)

> With these new problems, the workspace had to be updated and rethought for better efficiency and productivity. Told by an anonymous Google employee:
>
> "... if you have to work in one of the four main campus buildings, you will most likely be extremely cramped. It's not uncommon to see 3-4 employees in a single cube, or several managers sharing an office. With all the open areas for food, games, TV, tech talks, etc, it can be surprisingly hard to find a quiet, private place to think." (Edwarts, 2013) [23].

[23] Source: Google Employees Confess The Worst Things About Working At Google [in line]. www.businessinsider.com (consult. 13.1.14)

IDEO as a design firm whose primary goal is to focus on the user, invests in work environments that facilitate the working process:

> " IDEO's environments group design the space to combine the public and private aspects of a combined selling/work environment. The showroom is truly a working office environment, while the upper floor is a lab environment where there is a materials library, seating lab, and ergonomics lab available for client use. Also found there is the Globe project, which incorporates information technology into the office system to provide a vision of the future of group work." (IDEO, 1997) [24].

[24] Source: Worklife Chicago for Steelcase [in line]. http://www.ideo.com (consult. 13.1.14)

This new age created new needs in the working environment, the employee needs space and comfort as well as possibilities to distract himself, this method is widely used in Google and IDEO. When isolation is difficult because the workspace is shared and reduced, the little space available has to be enjoyed in a helpful manner. Chairs should adapt to various percentiles and allow to stretch the body, should also be padded and very comfortable, the secretary has to have enough space to have the

necessary objects, but also to write and/or draw, desks must therefore have drawers for storage. The interior of the building must also be thought strategically, taking into account the flow passage. A generation in which people live and work in a frenetic rhythm, requires a work environment that facilitates thinking, so that "fast and well" can be achieved.

Central heating

This area of design, boils down to the simple and functional. Interior climate control is a universal need that brings more comfort. However, heaters, unlike many other design objects, are hidden/disguised, and are usually white, to blend with the wall colours, and minimal. The most important part in the design of such items is to facilitate their use, by making an interface that is easy to understand and at the same time discrete. Often, instead of making discrete, it is chosen to camouflage the object, in an object with decorative functions (hiding the traditional look of a heating appliance).

Benchmarking

Office furniture

- **Kuubo** *by Naoto Fukasawa*

Image 23. Kuubo office table, 2010, Source: www.designlaunches.com

A versatile table designed for Vitra. Complete with storage compartments, large enough to store computers, files and other objects. It is elegant, simple, sophisticated and discrete, compartments are hidden. This table is designed to work in group, it is a table for brainstorming (designlaunches, 2014) [25].

[25] Source: Kuubo office table designed by Naoto Fukasawa with storage compartments [in line]. www.designlaunches.com (consult. 14.1.14)

- **OSOM ("Far from the eyes far from the heart")** *by Thomas Broen*

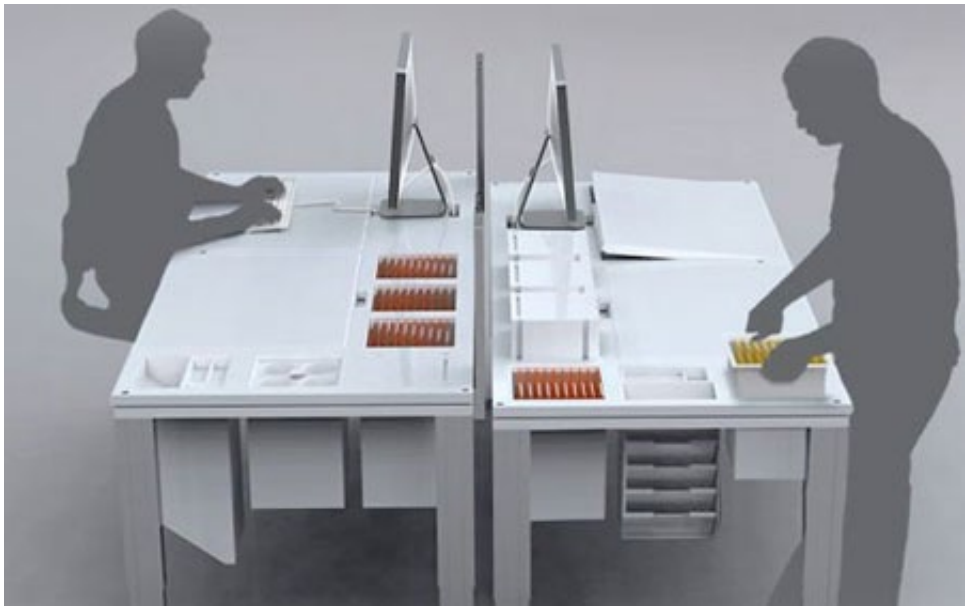


Image 24. OSOM office table, Source: www.tuvie.com, Author: Thomas Broen

OSOM is a new concept of workspace, which provides not only comfort but plenty of storage. When working long hours sometimes becomes difficult to keep everything organized, this table is well equipped with many modular storage units and ample and spacious shelves providing freedom to keep working without having to think about organization of the workplace. Because it is modular its shape is adaptable according to the user needs. This model hasn't yet been released in the market (tuvie, 2014) [26].

[26] Source: Out of Sight Out of Mind" (OSOM) Modular Table Concept [in line]. www.tuvie.com (consult. 14.1.14)

- **LUOTO** *by Danese Milano*

Image 25. LUOTO rest, 2008, Source: Danese Milano

Image 26. LUOTO work 2008, Source: Danese Milano

Serves simultaneously to sit and to store. Due to its versatility, it is a movable table and can also be transformed into a multifunctional structure that can be used as a shelf, a bed, a separation element or a private space. This table is intended to ensure that the needs of all users are met. It is a universal, dynamic and suitable object for any environment. The integration of the cut in the lower plan allows to seat better. The 2 materials used, wood and metal, are easy to separate for proper recycling. Moreover, the different product elements are easily fixed and replaced (Danese Milano) [27].

[27] Source: LUOTO [em linha]. www.danesemilano.com (consult. 13.1.14)

- **Lay Flat Chair**

Image 27. Lay Fit chair, Source: http://freshome.com

Lay Flat is an office chair that not only reclines back, but it can become a comfortable piece of furniture for resting, perfect for a break from work. Is equipped with a footrest that folds spontaneously and becomes a "bed" (freshome, 2012) [28].

[28] Source: Flat chair for complete office relaxation [in line]. http://freshome.com (consult. 13.1.14)

Central heating:

- **Thermostack heating system** *by Adriano Design*

Image 28. Thermostack heating, 2013, Source: http://mocoloco.com

ThermoStack, is a modular heating system with a central component of heat generation, connected to a satellite heat distribution. Has resemblance with a sound system so integrates well in the environment. The user can customize according to needs and taste (Adriano Design, 2013) [29]. According to Adriano Design (2013) This product is environmentally sound, respects all the requirements of quality, performance and lifetime of the object that are the foundation of a true green economy.

[29] Source: Thermostack heating system by Adriano Design [in line]. http://mocoloco.com (consult. 13.1.14)

● **Towels heater** *by Designer bathroom concepts*

Central heating, for towels with a mirror. With an innovative design, presents an ingenious fabrication which adds aesthetic taste to the performance of the modern bathroom. This is an elegant, luxurious and minimalist design. It is highly polished in stainless steel in three different size options. There is a variety of different compositions of horizontal and vertical bars, it is also a product with 25 years of warranty (Designer bathroom concepts) [30].

[30] Source: Mirror designer stainless steel central heated towel rails [in line]. www.designerbathroomconcepts.com (consult. 11.1.14)

Image 29. Towels heater, Source: www.designerbathroomconcepts.com

● **Rethinking the radiator** *by Rochus Jacob*

"In the past, radiators had to be placed underneath the window to establish a heat wall and create a natural circulation of warm air," (Jacob, 2009) [31]. This radiator is smaller, lighter and better looking, the energy use can be reduced, by sliding the green button down. The exterior is made of wood and plastic and has the same technology used to rapidly cool the computers and laptops. Besides cutting the power consumption, the boiler requires much less water (Jacob, 2009).

[31] Source: Rethinking the radiator [in line]. http//cargocollective.com (consult. 13.1.14)

Image 30. Radiator by Rochus Jacob, 2009, Source: http//cargocollective.com

DESIGN STUDIOS

Design processes

For a good final result of a design project it is necessary to maintain good working methodology that is well organized and outlined. It is necessary to use processes that facilitate both thinking and doing, thus the following methodological processes help to better organize the time in order to meet deadlines, minimize costs and please the customer.

There are no specific rules for the design process, each design agency/studio has its methods, however, all follow a similar order:

1- Ideas generation: start with a planning, research phase and concept phase(s) [32].

2- Development: of both concept and product engineering studies [33].

3- Execution: of the prototype to validate the idea, following of the project and production report [34].The production is normally performed by another entity and the design studio only provides the material and technical drawings necessary for its production, always following the project (however, varies in other studios and companies).

4- Communication: market launch, strategy and media, product tracking and results collection [35].

[32,33,34,35] Source: teacher Rui Marcelino theoretical lessons, this is the Alma Design agency design process

This presents a commonly shared base of any project with a beginning, middle and end, which then differs from company to company. It shows how each of these phases is developed, that is to say, witch methods and work tools are used, for example, different brainstorming techniques, analysis of field, among others.

Example of some project methodologies used:

Each model has its purpose, according to the book "Piccolo Manuale Delle Decisioni Strategiche" they can both help improving or understanding (me and the others). IDEO divides these methods in a different way, they created cards with 4 different categories: learn, look, ask and try.

How to improve?

- **Business model canvas**

The business model canvas is a tool that helps describing, designing, challenge, invent and articulate a business model(business model generation) [36]. The model is formed by 9 blocks: key partners; key activities; value proposition; customer relationship; customer segment, key resource; distribution channel; cost structure

[36] Source: The Business Model Canvas [in line]. www.businessmodelgeneration.com (consult. 27.11.2014)

and revenue stream. This enumerated components after being mapped it will be easier to brainstorm, the perfect idea for the next business model innovation (canvanizer) [37].

How does the business model work? First we start with the customer segment, this is, all the people and organizations for which we are creating value (simple users and paying customers), for each section of the business model canvas, there is a particular value proposition, this value proposition is what links the products and services that create value. The channels deliver value to the customer segment, the customer relationship shapes the type of relationship to have with the customer, the revenue streams tells how and which pricing tools in the business model are valuable. After, the infrastructure needs to be described in order to create, deliver and capture value, the key resources show the indispensable assets in the business model. The key activities, show the things that need to be well performed while the key partners show who can be a good and powerful influence in the business model (it is needed more than one entity for the resources and activities), finally, after this infrastructure is organized, it is possible to understand its cost (business model generation) [38].

[37] Source:Business model canvas [in line]. https://canvanizer.com (consult. 25.11.2014)

[38] Source: *Business Model Canvas Explained*, 2011, Video, Youtube

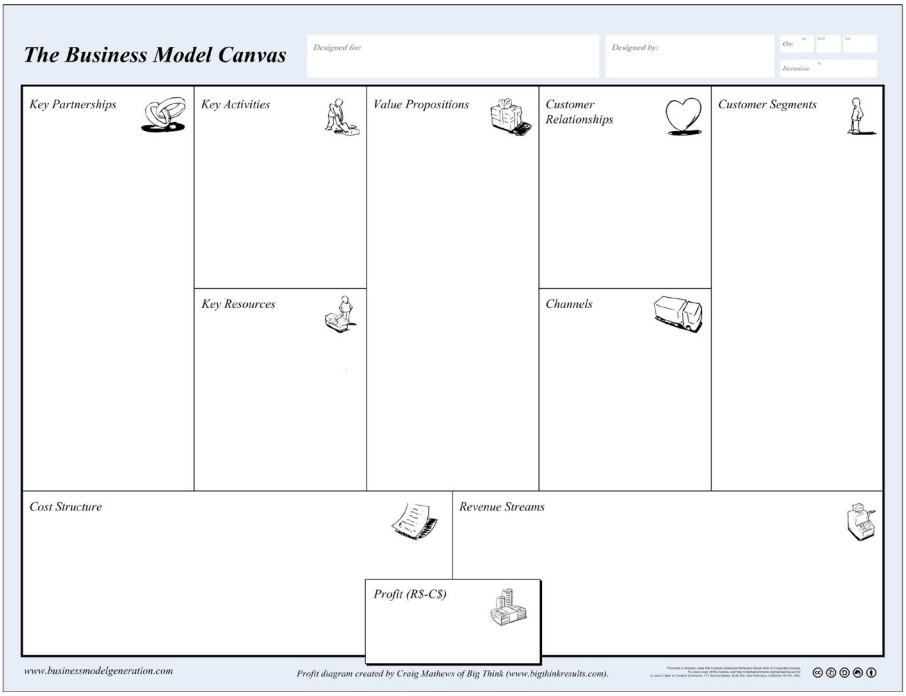
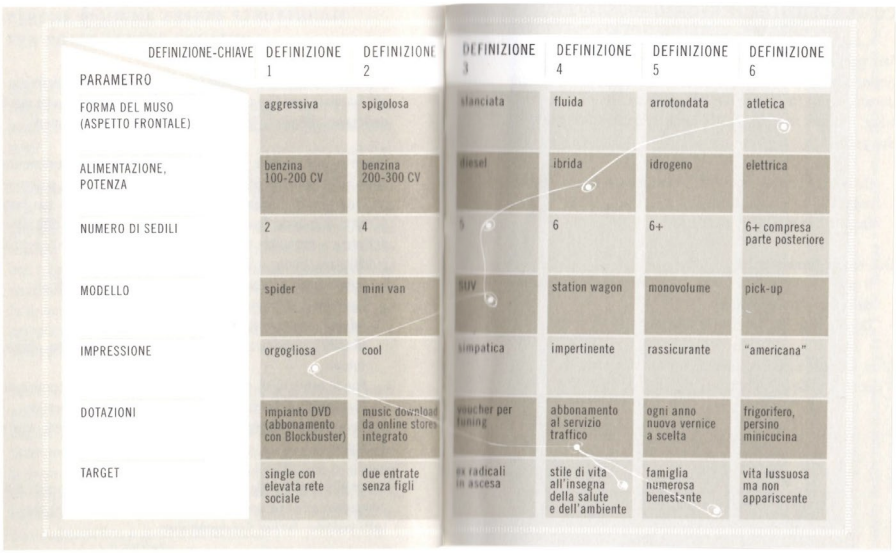


Image 31. The business Model Canvas, Source: http://bigthinkin.com (consult 25.11.2014)

● Morphological boxes and galloping model

It helps structuring, opening doors to creativity, this method combines what already exists in another mode, helping to create new ideas. Bib Eberle proposes a list of 7 essential questions: Replaces (people, components, materials)? Combines (with other objects or function)? Adapts (function, appearance)? Modifies (dimension, shape, appearance)? Puts to another use (new combination)? Removes (reduce, simplify, eliminate superfluous)? Reverses (use in the opposite way)? (Comi, 2011p. 28-31)



DEFINIZIONE-CHIAVE / PARAMETRO	DEFINIZIONE 1	DEFINIZIONE 2	DEFINIZIONE 3	DEFINIZIONE 4	DEFINIZIONE 5	DEFINIZIONE 6
FORMA DEL MUSO (ASPETTO FRONTALE)	aggressiva	spigolosa	slanciata	fluida	arrotondata	atletica
ALIMENTAZIONE, POTENZA	benzina 100-200 CV	benzina 200-300 CV	diesel	ibrida	idrogeno	elettrica
NUMERO DI SEDILI	2	4	5	6	6+	6+ compresa parte posteriore
MODELLO	spider	mini van	SUV	station wagon	monovolume	pick-up
IMPRESSIONE	orgogliosa	cool	simpatica	impertinente	rassicurante	"americana"
DOTAZIONI	impianto DVD (abbonamento con Blockbuster)	music download da online store integrato	voucher per tuning	abbonamento al servizio traffico	ogni anno nuova vernice a scelta	frigorifero, persino minicucina
TARGET	single con elevata rete sociale	due entrate senza figli	ex radicali in ascesa	stile di vita all'insegna della salute e dell'ambiente	famiglia numerosa benestante	vita lussuosa ma non appariscente

Image 32. Morphological boxes and galloping model, Source: Piccolo Manuale Delle Decision Strategiche p. 30-31

SWOT analysis

The SWOT analysis is used to help developing a strong business strategy, this can be used by both new and existing business, one to plan the process the other to assess a changing environment and respond pro-actively. In order to do that the strengths, weaknesses, opportunities and threats (SWOT) in the marketplace have to be considered and organized in a list. Strengths and weaknesses are internal to the company and can't be changed in the future, this is for example, the company reputation, patent and location. Opportunities and threats are external and can't be changed, this is for example the suppliers and competitors (Bplans) [39]. The SWOT model relates the strengths and weaknesses of a project with the main trends of its environment. The threats are always latent opportunities. After identifying the strengths, weaknesses, opportunities and threats (SWOT) of a particular project, a new swot analysis is created in which threats are replaced with medium/long term opportunities (Almendra) [40].

[39] Source: What Is a SWOT Analysis? [in line] http://articles.bplans.com (consult. 27.11.2014)

[40] Source: teacher Rita Almendra theoretical lessons

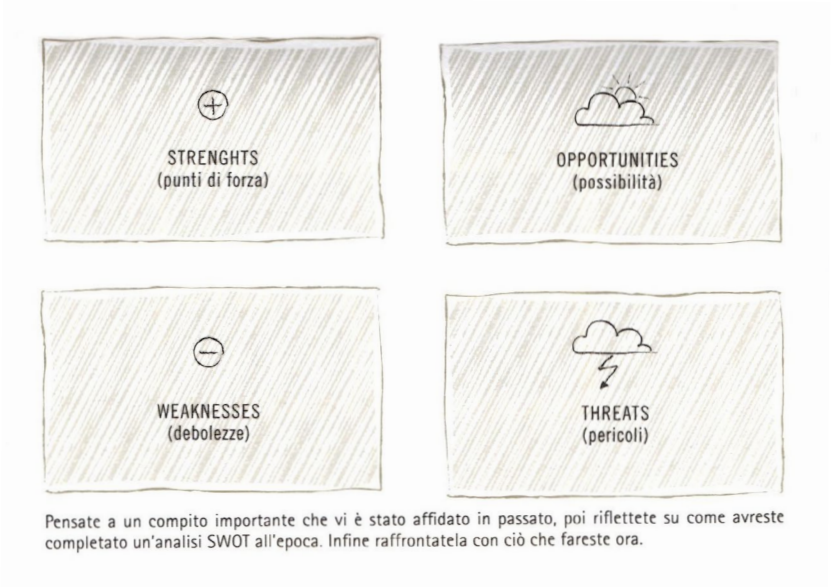


Image 33. SWOT model, Source: Piccolo Manuale Delle Decision Strategiche p.13

How to understand?

- **Making-of model**

It helps to know the past to improve the future, this is, it helps discovering the most important elements in the past, by putting aside those that can be forgotten and keeping those relevant for the future.

So how does the making-of model work? In a precise period of time (time line) it is noted what were the goals, what was learned, which objectives were exceeded, the successful lived experiences and who was important in a specific (Comi, 2011 p. 68-71)[41].

[41] Source: *Piccolo Manuale Delle Decisioni Strategiche*

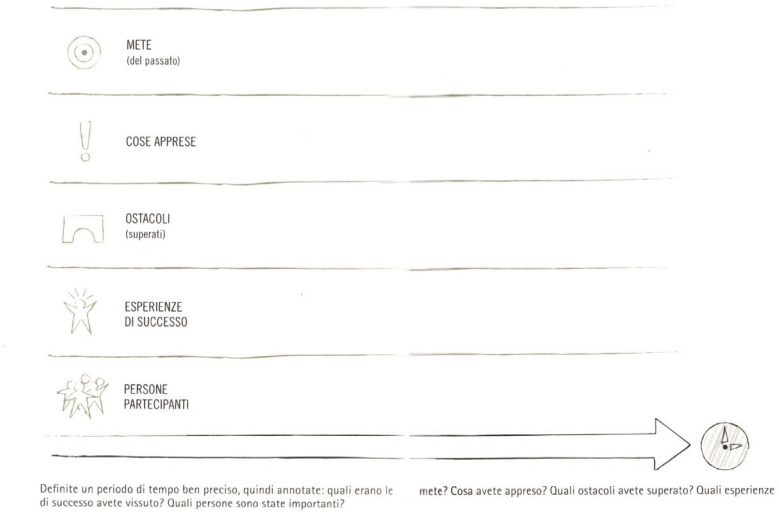


Image 34. Making-of model, Source: Piccolo Manuale Delle Decision Strategiche p.68-71

- **De Bono model**

The 6 thinking hats were created in 1986 by Edward De Bono. De Bono model is used as a technique to manage a team or a meeting and improve communication, the participants discussing an idea or strategy, have to select between six different hats, all members of the group have to be using the same hat. Each hat represents a different phase of the thinking process, the steps have to be taken in the following order (Frota, 2009)[42]: we start with the blue hat that represents the order and moderation, this hat has an overall view of the process, the big picture; the white hat represents the analytic thinking, that is, objective and refers to concrete data and feasibility; the green hat represents the creative thinking, it's the phase of ideation; the yellow hat represents the optimistic thinking, promotes the best-case scenario, in this phase, the team has to give positive comments about the ideas created before; in opposition, we have the black hat that represents the critical thinking that is based on the observation / evaluation of the risks and problems; the red hat represents the emotional thinking, the subjective concerns, the feelings and opinions related to the topic of discussion or idea, in this phase people are moved by intuition; finally again the blue hat to make conclusions and close the meeting (Comi, 2011 p. 140-141).

[42] Source: Modelo Gestao De Ideias 6 Chapeus Do Pensamento Edward De Bono [in line]. www.slideshare.net (consult. 25.11.2014)

Drexler/Sibbet team performance model

Allan Drexler and David Sibbet, founders of the business consulting firm Grove created a model that explains how to create and manage a team in a clear, immediately and obvious way (Comi, 2011 p. 128). This model helps as well planning projects in order to maximize productivity and optimize the work flow of a team effort. Their model, shows 7 different phases/stages: orientation, trust building, goal clarification, commitment, implementation, high performance, and renewal. Each stage is identified by one primary question of concern for team members when they are in that phase (strengthening non profits) [43].

So how does the team performance model work? We have to follow the arrows, on the stages toward the top of the diagram (the beginning and end), teams feel a greater sense of freedom when on the bottom teams feel more constraints [44]. The first 4 phases represent de team development, while the next 3 represent the performance phases [45].

[43,44,46,47,48,49,51] Source: Team Management and Performance Tools [in line]. www.strengtheningnonprofits.org (consult. 25.11.2014)

[45] See image 35

The 7 steps:

1. Orientation - Why am I here? By working together, each member of the team has to identify a task personally beneficial, useful, or important to the organization, otherwise, they will feel disconnected from the group and its goals [46].

2. Creating Confidence - Who are you? The trust building phase, is the stage during which people want to know who they will be working with and who is responsible for what [47].

3. Clarifying the Objective - What are we doing? The goal clarification phase, is the stage during which the team identifies a shared vision by discussing possibilities and if the goals may or may not be the best options [48].

4. Compromise - How do we do this? The commitment phase, it is when the team has to realize if everything is ready to move to the performance stage (if the previous steps complement each other), or if they need to review their previous steps [49]. Everything is working fine when staff assigned the roles, allocated resources and can easily make decisions without major concerns (Serrao, 2014) [50].

[50, 52] Source: 7 Steps to create and maintain high-performance teams (New ways to Win) [in line]. www.linkedin.com (consult. 25.11.2014)

5. Implementation: who does what, when and where. This is team action phase, this step is dominated by timing and planning (use of management tools, flowcharts, or work plans), again, it might be necessary to go back some steps/phases if the team meets unexpected obstacles, so that they can find the problem and fix it [51].

6. High Performance - WOW. This is what everyone dreamed of. The team has to be working united and fluid, if everything is functioning well, when new goals are created the team will adapt easily. If something is wrong the team will feel, overloaded and stressed (Serrao, 2014) [52].

7. Renewal - Why continue? In this phase the team decide in renewing or ending the project. Team members reflect about what worked or didn't work and what can be left behind and what remains (Serrao, 2014) [53].

[53] Source: 7 Steps to create and maintain high-performance teams (New ways to Win) [in line]. www.linkedin.com (consult. 25.11.2014)

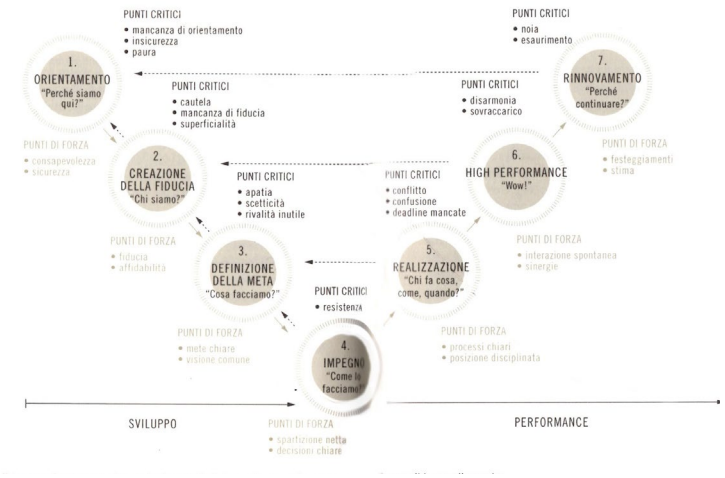


Image 35. **Drexler - Sibbet team performance model**, Source: Piccolo Manuale Delle Decision Strategiche p.130-131

- **Moodboard**

The moodboard is a essential tool used by creatives, especially by designers, to show their visual interpretation of a client demand for a particular project or concept. Before starting a moodboard usually we follow a client brief, so it is possible to have an idea of the company background, their target audience and any distinguishing characteristics. The main purpose of a moodboard, is to help others to "get inside the designer head" in order to explain a mood or concept. It can be explained by using visual elements, such as images, text, fonts, shapes, colours, icons, textures, among others (Jones) [54]. This tool is used in the research phase of a project, in a design studio, the designers should start by researching the brief topics, according with the research conclusions, the designers brainstorm some ideas or themes that could answer to the customer requirements, after, the designer will explain those ideas by elaborating visual boards.

[54] Source: Why moodboard? [in line]. http://everydaydesigner.net (consult. 25.11.2014)

IDEO method cards

These cards are an inspiration for practicing and aspiring not only designers as well as those seeking creativity in their work. IDEO methods always keep people at the centre of the design process. The cards are divided into 4 categories: Learn, Look, Ask and Try. Some Examples [55]:

[55] The following examples of IDEO methods were taken from the source: IDEO method-cards [in line]. www.slideshare.net (consult. 25.11.2014)

Learn

- **Error analysis**

By making a list of things that may result bad when using a particular product and

determining the various possible causes, it is possible to understand how design features minimize or contribute to human errors and other failures.

- **Flow analysis**

By representing the flow of information or activity through all phases of a system or process, it is possible to identify opportunities for functional alternatives.

- **Historical analysis**

By comparing features of an industry, organization group, market segment, and/or by practicing through various stages of development, it is possible to identify trends, cycles of product use and customer behaviour, the results will help projecting those patterns into the future.

Look

- **Fly on the wall**

It is useful to observe and record peoples behaviour on a daily basis in a particular real life context, instead of accepting what they said about what they did and how they behaved.

- **Shadowing**

By tagging along with people to observe and understand their day-to-day routines, interactions and contexts, it is possible to reveal design opportunities and show how a product might affect users behaviours.

- **Rapid ethnography**

By spending as much time as possible with people relevant to the theme of the design project and establishing confidence in order to be able to visit and/or attend to their activities, it is possible to reach a deep comprehension of habits, rituals, natural language, and meaning around relevant activities and artefacts.

Ask

- **Cognitive maps**

By asking participants to map an existing or virtual space to show how they would move in that, it is possible to discover the elements, pathways and other

significant spacial behaviours associated with a particular real or virtual place.

- **Extreme user interviews**

By identifying individuals who are extremely familiar or completely unfamiliar with a specific product and asking them to evaluate their user experience, it is possible to highlight key questions of the design problem and provide insights for design improvements.

- **Sort cards**

On separate cards, name possible features, functions or design attributes. Ask people to organize the cards in ways that make sense to them. This helps exposing the mental planes, the organization of these plans reveals expectations and priorities over the desired functions.

Try

- **Behaviour sampling**

By giving people a pager or a phone and ask them t record and evaluate the situation they are in when it rings, it is possible to discover how services and products get incorporated into people's routines in unexpected ways.

- **Be your client**

By asking the client to describe and point his typical user experience, it is possible to help the client uncovering the perspectives of his regular client and provide an informative contrast for experiences of existing customers.

- **Quick and dirty prototype**

The prototype has to be made rapidly with any available material by hand, making a quick assembly of possible forms or interactions for evaluation. This is a good way to communicate a concept to a team work and better evaluate the idea.

3. Study case

MBD DESIGN About the agency

What

MBD Design is an global design agency founded in 1972 in Paris. It is known internationally by the Design of Transports; it's one of the leading companies in the sector. Its business expands throughout Europe, Asia and Middle East, (MBD Design, 2014) 70% of their projects are in the export markets, particularly in Asia (MBD Design, 2014)[1]. Nowadays it's located in 15 rue de Sambre et Meuse, 75010 in Paris.

[1] Source: MBD Design files

Awards

MBD Design won over thirty international awards. Some examples: in 2013, with the project XLED won an award from the *Red Dot Design* for a range of lighting equipment for operating rooms. In 2012, with the prototype RapidFire, the agency was awarded by *Thales Innovation* with a silver medal for the group with the most innovative designs from more than 11 years. In 2007 was awarded a star on the *Observeur du Design* for the Marseille tram design. Also on *Observeur du Design* in 2008, with two stars, the first star for the TGV KTX II in Korea. The second star for the design Powerled, a new scialytic [2] light, equipped with electroluminescent diodes (LED)(MBD Design, 2014)[3].

[2] Lighting fixture used in operating rooms that suppresses shadows (MBD Design, 2007)

[3,4] Source: Stéphane Pottier

Exhibitions

The agency also participated in several exhibitions, some more than one consecutive year: In *Eurosatory* in Paris, In Metro Rail in Copenhagen, in *MENA* in Dubai, in *Innotrans* in Berlin, in *Railway Interiors* in Amsterdam, in *Railway Interiors* in Beijing, among others (MBD Design, 2014)[4].

Philosophy

MBD Design is characterized by two adjectives, talent and pragmatism. Talent, "La dimension la plus insaisissable du design, mais aussi l'ingrédient indispensable à la réussite de tout projet",[5] the agency seeks to integrate the best designers in the team, for them "Notre obsession est l'innovation" [6]. Pragmatism, several years of experience, supported by a good cultural, economic and technical know how, the responses of the agency always match the ambitions of the project, the main goal is to direct all creations for a positive return on investment for customers (MBD Design, 2014).

[5] Free translation: "The most elusive aspect of design, but also the essential ingredient for any project's success."

[6] Free translation: "Our obsession is innovation."

Internal dynamic

Staff

It's currently composed by 9 members of which 7 are designers, MBD Design also works with 4 freelance designers and constantly has 2 to 3 interns. Internships usually have a duration between 4 to 6 months.

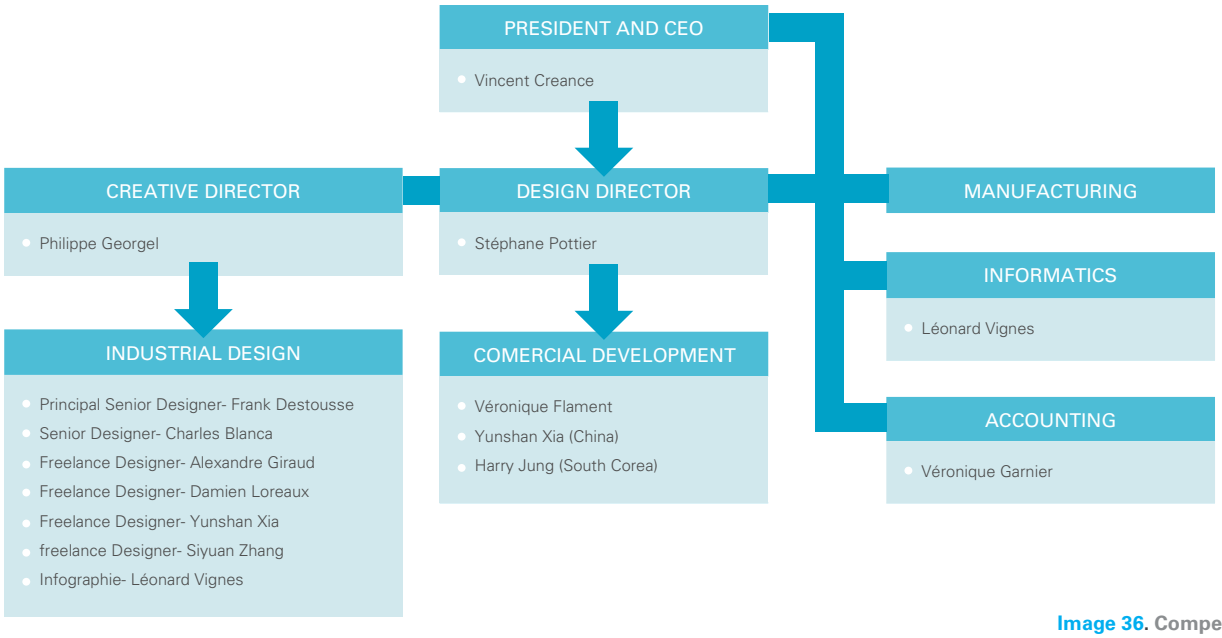


Image 36. Competencies chart, 2014, Author: MBD Design

Schedule

The working schedule goes from Monday to Friday from 9 am to 6 pm, on Fridays everyone who works in the afternoon leaves the office at 5pm. Lunch break is approximately 1.30h between 12am to 2pm.

The CEO Vincent Creance usually works during mornings but doesn't have a steady schedule, he is also many times absent due to meetings with clients; the Design and Project Director Stéphane Pottier works only from Monday to Thursday, sometimes he is also absent due to meetings with clients; the freelance designer Yunshan Xia works all mornings from Monday to Friday, the other 3 freelancers come to the office only when needed, sometimes they work from home; Harry Jung, the commercial representative for Korea he never works at the office in Paris.

Work environment

The work environment is nice, quiet and friendly, most of the employees worked for the company for several decades which provides trust and relaxation within the

workplace. It's usually calm at the office - However there are some more stressful occasions but it's usually possible to finish the projects in time without having to do extra working hours.

Breaks

During the day, there are several breaks for coffee and snacks (each person brings and shares). At lunch time the designers eat together in the dining room, there is no canteen so the food is purchased at the supermarket or at the restaurant. Each employee is entitled to a 9€ daily meal ticket.

Refunds

MBD Design covers expenses such as: transportation costs for field analysis, meetings, exhibitions, among others, whether for short course (in Paris) or long course (in France or other countries); cost of tickets for exhibitions (for projects inspiration); in case of long journeys also covers accommodation. Véronique Garnier is who deals with refunds, she is the responsible for accounting and human resources at the agency.

Absences

Should be advised until at least the day before, in case of holidays shall be earlier. In an emergency must contact the company as soon as possible for reasons of work accident insurance.

Material replacement

Véronique Garnier is who orders more office material or coffee (paid by the company).

Management

- **Vincent CREANCE** President and CEO

Manager of MBD Design since 2006. Graduated from ESDI (Industrial Design School). Starts his career in the Plan Creatif Agency in 1985 where he becomes Design Director in 1991. Joins Alcatel in 1996 as Design Director and is nominated Vice-President of the Mobile phone division in 1999 and Design and Corporate Communication Director of the TCL & Alcatel Mobile Phones Joint Venture in 2004. Is currently member of the Board of Director of APCI (Agency for the Promotion

of the Industrial Creation), member of the Board of Director of ENSCI (School of Industrial Creation), member of the Board of Director of le Lieu du Design and member of the Strate Collège's scientifical council (MBD Design, 2014) [7].

[7, 8, 9] Source: Management [in line]. www.mbd-design.fr (consult. 15.9.14)

- **Stéphane POTTIER** Design and Project Director

Join MBD Designe in 1983 as Project director of several projects. Few years after becomes Design Director. Graduated from ENSAAMA. Starts his career in 1982 within Forme Industrielle Design Agency. Directed projects as Korean KTX II, TGV 3G, TEOZ, AGC, Metros in Singapore, Shanghai, Nanjing, Marseille, Reims, Strasbourg, Nancy, Caen Tramways, MI2N, suburban SNCF vehicles, among others (MBD Design, 2014) [8].

- **Veronique FLAMENT** Development Director

Joins MBD Design in 2005 to be in charge of the international development and the contractual relations of the Agency. Started as a Financial Analyst in General Motors France. After, from 1990 to 1995 becomes a Export Manager in Ocean Computer in Hong Kong. Becomes Branch Manager for the group in South Africa before to go back to France to create and manage the European branch office (MBD Design, 2014) [9].

Employees

- **Philippe GEORGEL** Creative Director

Joins MBD Design in 1990. Graduated from ESDI (School of Industrial Design) in 1989. Starts his career in the same year working as a junior Designer for Gauthier Design Industry and Alain Carre Study Design. Main projects: Transport lamberet Irisbus; Tramway of Reims, Strasbourg, Nancy and Caen; Metros of Singapore, Shanghai, Nanjing, Paris (MI2N, MF77, MF88); TGV trains 3G, AGC, Coral and material commuter train; Furniture Majencia, Steelcase and Agorespace; Defence Thales, DCNS, and Dongfeng; Juvenile Dorel Tigex; Medical Aphycare; Air Conditioning Carrier and Lennox (MBD Design, 2014) [10].

[10] Source: MBD Design files

- **Frank DESTOUSSE** Principal Senior Designer

Joins MBD Design in 1994. Graduated from ESDI (School of Industrial Design) in 1995. Starts his career in 1992 for Methagryl (POS) and Citroën as junior Designer. In 1994 worked for Display Program (POP) as a freelance Designer. Main projects: Tramway of Reims, AGC, and Hong Kong; Metro of Hangzhou, Suzhou (line 1),

Mumbai, Rio, Singapore, Shanghai, Nanjing, Metro MF77 and Strasbourg; Train du Puy de Dome, renovation of RER (MI 79), material suburban SNCF, TER 2N and TER 2N NG; Defence DCNS and Thales (MBD Design, 2014) [11].

[11,12,14] Source: MBD Design files

- **Charles BLANCA** Senior Designer

Joins MBD Design in 2009. Graduated from Strate College (Design School) in 2008. In 2006 did an internship in MBD Design during 4 months and an internship for L'atelier du vin during 6 months in 2007-2008 (Linkedin, 2014). Is now in charge of many major projects of the agency, including metro projects looking for the MTR Express Rail of Hong Kong (MBD Design, 2014) [12].

- **Alexandre GIRAUD** Freelance Designer

Joins MBD Design as a Freelance Designer in January 2014. Graduated from ESDI Creapole in 2011. Workd as an Intern for several companies: In Lota design in 2008; in Holywave and in Mantano in 2010. Started his carrer as a Product Designer in 2010 in Waykup. After his graduations started working as a freelance designer until now, worked for companies such as Victor Alexandre, Veuve Clicquot Ponsardin, Hennessy, Nicolas Bernardé, KRG Corporate and Hachette Livre (Linkedin, 2014) [13].

[13] Source: Alexandres Giraud [in line].www.linkedin.com (consult. 16.9.14)

- **Damien LOREAUX** Freelance Designer

Joins MBD Design as a Freelance Designer in 2012. Graduated from Strate College (Design School) in 2011. Workd as an Intern for several companies: In Neurotic during 4 months (march to June) in 2009; in Vincenti Design during summer 2009; in YAPPA Coporation from October 2009 to January 2010; in Neovenz during summer 2010 and in Modelabs during 8 Months in 2011 (MBD Design, 2014) [14].

- **Yunshan XIA** Freelance Designer

Joins MBD Design as a Freelance Designer in 2010. Graduated from ENSCI (National School of Industrial Creation) in 2010. Speaks Chinese, French and English. Works manly on international train, tramway and metro design projects. Coordinates as well the communication around design contracts with their customers abroad, which includes some traveling (Linkedin, 2014) [15].

[15] Source: Yunshan Xia [in line].www.linkedin.com (consult. 16.9.14)

- **Siyuan ZHANG** Freelance Designer

Joins MBD Design as a Freelance Designer in 2012 (Doesn't work at the office). Graduated from Zhejiang University (Bachelor of engineering/ Industrial Design) in

2007, in 2009 graduated from Ecole Supérieur des Beaux Arts of Marseille (Bachelor of Arts) and in 2012 from ESAD Reims (Master in Product Design). Speaks Chinese, Shanghainese, French and English. Worked as an intern/assistant in Vincent Dupont-Rougier for 6 months in 2011 (MBD Design, 2014) [16].

[16,18] Source: MBD Design files

- **Léonard VIGNES** Informatics/ Infography

Joins MBD Design as a Multimédia Designer in 2001. Graduated from ESEC (School of film studies) in 1991. Started his career at Net-Musical as an infographist in 1999 and in 2000 worked 8 months for Eisemusic. At MBD Design he is responsible for the creation and track of the website (web design / web mastering), for the creation of communication media (CD-Rom, Design book), modelling and animation design productions and networks administration (Linkedin, 2014) [17].

[17] Source: Léonard Vignes [in line].www.linkedin.com (consult. 16.9.14)

Services

MBD Design is currently developing global design solutions: Transportation Design, Interior design, Defence design and Product design (both industrial and domestic products) (MBD Design). Previously the company also had a graphic design department. Mainly develops public transport on rail lines (TGVs, trains, and electric meters) (MBD Design, 2014) [18].

Clients

The agency MBD Design is a small / medium company with a wide number of customers. Collaborated on projects for various renowned companies such as SNCF, Alstom, Bombardier, DCNS, Delta Dore, Maquet, Renault Trucks, Legris, Rotem, Samas, Thales, among others (France design innovation, 2009) [19].

[19] Source: MBD Design [in line]. www.francedesigninnovation.fr (consult. 11.1.14)

The most recent projects (the past few years) went to companies such as: ADA, ADP, Atlantic, Barriere Automatique, Bombardier, CCR, CRC, CSR Puzhen Nanjing, CSR Sifang, CSR Zhuzhou, Daher, DCNS, EGIS, GHD, Hong Kong Tramway, IMV Technologies, INGÉROP, IRICO, Iveco, Korail (Korea Railroad Corporation), Majencia, Markcom, Metrolab, Mitsui, Mondo, Montpellier Agglomération, MTR Corporation, Nexter, OBB, Ozbir Vagon, Panasonic, Peugeot, Pinet, RATP, Rhonexpress, Rotem, SANEF, Sigma, SNCF, SNC-Lavalin, Stago, STIF, Sunviauto, Systra, Tecmar, Thales, Tracetel, Tramcites, Transamo, Yong Song, among others.

Design positioning

(MBD Design doesn't have any brand or design positioning scheme developed. Most of the following information is based on research and personal knowledge from time spent at the agency.)

According to Philip Kotler "positioning is the act of designing the company's offering and image to occupy a distinctive place in the target market's mind" that is, how a product is perceived in the mind of a consumer. Design positioning stands for the design strategy used by the agency, what makes MBD Design good in the eyes of the its clients.

So how should a good product be, and what makes MBD Design successful? The following aspects are responsible for MBD Design achievements:

1. Location: A prime location on a niche expansion;

2. Trust: A unique portfolio of references all around the world, the agency has been successful for decades it's a leader in the sector;

3. Good working environment: MBD Design works with the same employees for several years, this makes a friendly and pleasant working environment.

4. Encouragement of education and personal achievement: For the constant presence of interns, opportunities to visit museums and prototyping centers, among others;

5.Talent: A unique and proven ability to combine creativity and industrial realism;

6. Communication: Constant dialogue between colleagues;

7. Updated: about new technologies and innovations in design, the agency attends several international exhibitions and constantly receives design magazines.

8.Teamwork: tasks distribution between colleagues and frequent communication on project development.

9. Method: Tasks distribution, use of simple design thinking processes such as mood boards, benchmarking and project synthesis;

10. Identity respect: Respect for briefings, brand identity and clients wishes;

Main projects

This chapter is organized, giving greater emphasis to the design of rail public transports, that is the main focus and for which MBD Design is recognized worldwide. The following examples were chosen: 4 examples of rail public transports, 2 trains and 2 trams, and 2 examples of products.

Public transport projects

- **KTX II** *produced by ROTEM*

Image 37. KTX II exterior, 2008, Source: MBD Design

Image 38. KTX II passenger cabin, 2008, Source: www.mbd-design.fr

Image 39. KTX II bar, 2008, Source: www.mbd-design.fr

KTX-II was the first commercial high-speed train developed in South Korea. Travels along the Gyeongbu Line, the train has been in service since 2010, and can travel just over 300 km / h (news cnet, 2013) [20]. It was designed for the Korean operator Korail to connect the city of Seoul to Mokpo. The design considers some Korean cultural elements, but also international elements. The exterior features dynamism and speed, volumes are inspired by terrestrial and aquatic animals present in Korean culture. The overall look inside emphasizes local travel habits: indirect lighting, swivel seats and passenger privacy. The colours and patterns also respond to the collective imagination of travellers. The graphics in general are also inspired by cultural symbols.

In short, a TGV with luxury as it is seen in the country with wood panelling and dark glasses, with respect for Korean culture and maintaining an international style.

This project has satisfied 85% of the Korean population and was awarded a star on Observeur du Design in 2008 (Flament, 2008) [21].

[20] Source: South Korea's KTX 2 [in line]. http//news.cnet.com (consult. 15.1.14)

[21] Source: News & Press KTTX II [in line]. www.mbd-design.fr (consult. 15.1.14)

● **Reims tram** *produced by Alstom*

Image 40. Reims tram exterior, 2008, Source: www.mbd-design.fr

Image 41. Reims tram front, 2008, Source: www.mbd-design.fr

Image 42. Reims train interior, 2008, Source: www.mbd-design.fr

Operated by TUR, MARS and Transdev, carries about 45,000 people a day for over 23 seasons. The vehicle body is composed by five sections and has capacity for 205 passengers, including 56 seated.

Travels through the city from north to south, along a track 11 miles long. The project cost € 342,780,000. Came into use in April 2011 (Wikipedia, 2013) [22].

This tram is available in three colours, green, orange and blue, the MBD Design sought to develop expressive forms, strong colours are maintained throughout the tram, giving a light and bright movement (Flament 2008) [23]. The windshield has a unique concave shape, like a glass of wine.

The furniture in opposition to the vibrant exterior is made with more muted colours, exterior colours are carried by the lighting to the interior through the tinted windows. This electric with sporty lines, is a symbol that brings meaning, creates links and enriches the city (Flament, 2008).

[22] Source: Reims tramway [in line]. http//en.wikipedia.org (consult. 10.1.14

[23] Source: A concept of shape for the Reims tramway [in line]. www.mbd-design.fr (consult. 15.1.14)

- **TGV 3G** *produced by COMPIN and SNCF*

Image 43.TGV 3G passenger cabin 1, 2006, Source: www.mbd-design.fr

Image 44. TGV 3G bar, 2006, Source: www.mbd-design.fr

Image 45.TGV 3G passenger cabin 2, 2006, Source: www.mbd-design.fr

These high-speed trains were built by Alstom between 1992 and 1996. They are formed by 2 power cars and 8 carriages, allowing a capacity of 377 places and travels at a maximum speed of 300 km/h (Wikipedia, 2013) [24].

These trains were renovated between 2004 and 2006. MBD Design executed the carriages interior designs in partnership with the fashion designer Christian Lacroixas and SNCF (Wikipedia, 2013).

The carriages on the exterior are defined by three colors: red for 2nd class, green for 1st class and silver to the bar and stripes reflecting on the sides of the car (Wikipedia, 2013).

The design is modern and colourful, plays with contrasts between purple and orange, the bar has some details in yellow. The colours blend with the gray/silver unifying the space and creating a pleasant environment.

[24] Source: SNCF TGV Réseau [in line]. en.wikipedia.org (consult. 11.1.14)

● Flexity Outlook - Marseille *produced by Bombardier*

Image 46. Marseille tram exterior side, 2006, Source: www.mbd-design.fr

Image 47. Marseille tram exterior front, 2006, Source: www.mbd-design.fr

Image 48. Marseille tram exterior interior, 2006, Source: www.mbd-design.fr

The CUMPM selected Bombardier to develop and manufacture 26bidirectional trams in Marseille in 2004 The new trams can carry up to 158 passengers including 42 seated (Bombardier, 2014) [25].

The design developed by MBD Design is innovative and unique, the tram was inspired in a maritime theme, the front resembles a boat, the interior is composed of a natural scheme of wooden seats. The blue interior further accentuate the Mediterranean influence. The large windows offer a panoramic view and create a sense of transparency (Bombardier, 2014).

[25] Source: Our modern metros: helping cities breathe [in line]. www.bombardier.com (consult. 11.1.14)

NEO 1 *para SAMAS*

Image 49. NEO 1, 2008, Source: www.mbd-design.fr

Image 50. Neo 1 keyboard detail, 2008, Source: www.mbd-design.fr

This new table called NEO 1 was rethought to be a new concept of workspace, includes new functionalities, offering an innovative and simple design (MBD Design) [26].

It is designed to meet the new working methods of business, ensuring a high level of communication, ergonomics, comfort, safety and identification of individual space. The project is thought to leave the work area clean, the keyboard is a laser projection, computer interfacing allows storing the user profile. Recognized with a digital identification module, the user profile can be adjusted: adjusted for height, ambient lighting, light intensity, graphical interface (MBD Design).

Neo 1.0 was presented to the public for the first time during the international exhibition in Paris SISEG (MBD Design).

[26] Source: News & Press - Samas [in line]. www.mbd-design.fr (consult. 15.1.14)

[27] Source: News & Press - Powerled, a luminous ring [in line]. www.mbd-design.fr (consult. 15.1.14)

Powerled *para MAQUET*

Image 51. Powerled, 2007, Fonte: www.mbd-design.fr

Lighting used in operating rooms that suppresses shadows. Powerled is a scialytic light endowed with electro-luminescent diodes (LED). With its light performance, Powerled offers an image of excellence. Powerled is innovative: thin, light and aerodynamic. The concept is based on a ring-shaped structure with an emphasis on the circulation of fresh air, a key element to protect workers and patients against contamination. The shape and attention to detail facilitates maintenance and reduces cleaning time (MBD Design) [27].

Work methodology

MBD Design has a pre-defined work methodology (image 52) however, this may vary according to the project needs. At the beginning of each project, first, all necessary information is gathered, that is, after the meeting with the client and after the preparation of a draft with technical and legislative specifications and with the desired project objectives. After these previous aspects are defined and presented, the team convenes in order to distribute tasks and define who is responsible for the project. Interns provide assistance especially in the initial creative research phase, that is to say, research of inspiration and concept development.

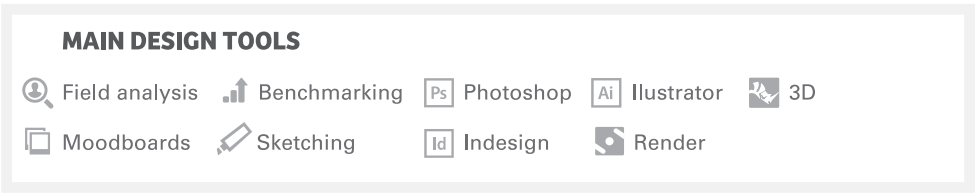
For each project some designers are designated to be in charge. During the design process the designers are more or less aware of each other's works, but not fully always (particularly trainees), this happens due to the amount of work being undertaken at the same time. The design director is the one who always follows everything. Tasks are distributed according to the availability of the various team members and in accordance with their "strengths".

During each project the designers in charge and the design director get together several times to show the project development and to discuss possible improvements, it is also a way to ensure that the work will be ready on the dates requested by the customer. This happens especially in the creative research phase when developing mood-boards, benchmarking and the various existing concepts The team gathers when necessary, there are no pre-defined dates.

When the project is worked on by several designers, they try to maintain a graphical consistency in terms of renders. It is the design director who often makes the presentations for the client.

Email is the most practical way of contact between the different members of the agency as well as to contact customers. Trainees do not have an agency email (other employees yes) they contact the other members by using their personal email.

Depending on the project and its location sometimes is necessary to travel for field analysis (for space recognition and target analysis) for example, of a particular bus route. International exhibitions and meeting with clients is also a reason for traveling. The following chart is a summary of the work methodology used by MBD Desgn, it is based on information provided by the agency.



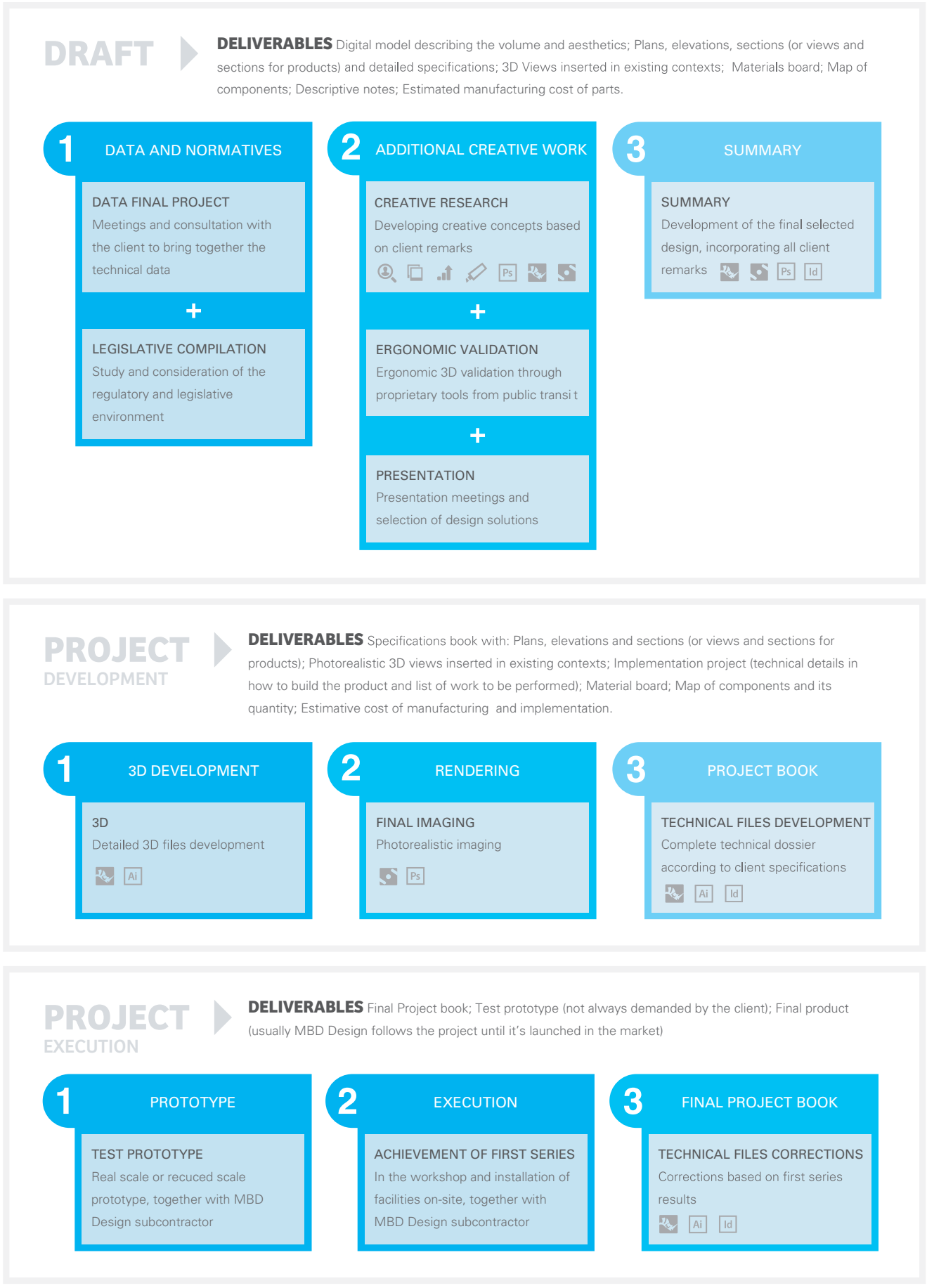


Image 52. Methodology chart, 2014, Author: Sofia Malato

4. Research proposal

ARGUMENT

Development of various products within the theme "Product Design in studio: Design of rail collective transports, design of products and spaces" such as devices for welding, a transport information point, among other products. Requirements will be different from project to project within the working context of MBD Design.

RESEARCH DESIGN

From the product design field, the design of transports, domestic appliances and industrial appliances will be addressed, with the theme: Product design in studio. This will take into account the design of rail collective transports and industrial and domestic appliances. After having defined the investigative topic, the preliminary study will begin through the use of a qualitative methodology as an interventionist base. This methodology is composed by four phases: collection, selection of data, data analysis and critical synthesis.

In order to proceed with the investigation, one literary collection / criticism relating to the theme is made, studying authors and reference projects to better understand the study area. This collection will be carried out over the internet and libraries by exploring books, theses, and journal articles, using keywords intersection, from a general aspect to those more specific. After this, the state of art will be initiated based on findings in the literature, and from these findings it will be possible to discover a theoretical context.

Then comes practical phase, where it is possible to establish an argument to prove we can use a project methodology of active research. With the application of this methodology it is possible to develop projects that will deliver results which in turn, will be evaluated and validated by the client. The input of the customer will serve to evaluate results. From there, it will be possible reach the conclusions of the study and whether these findings are in agreement with the argument, which in turn could lead to innovations to the theme, University and the community, as well as clues / recommendations for future investigations.

ORGANOGRAM

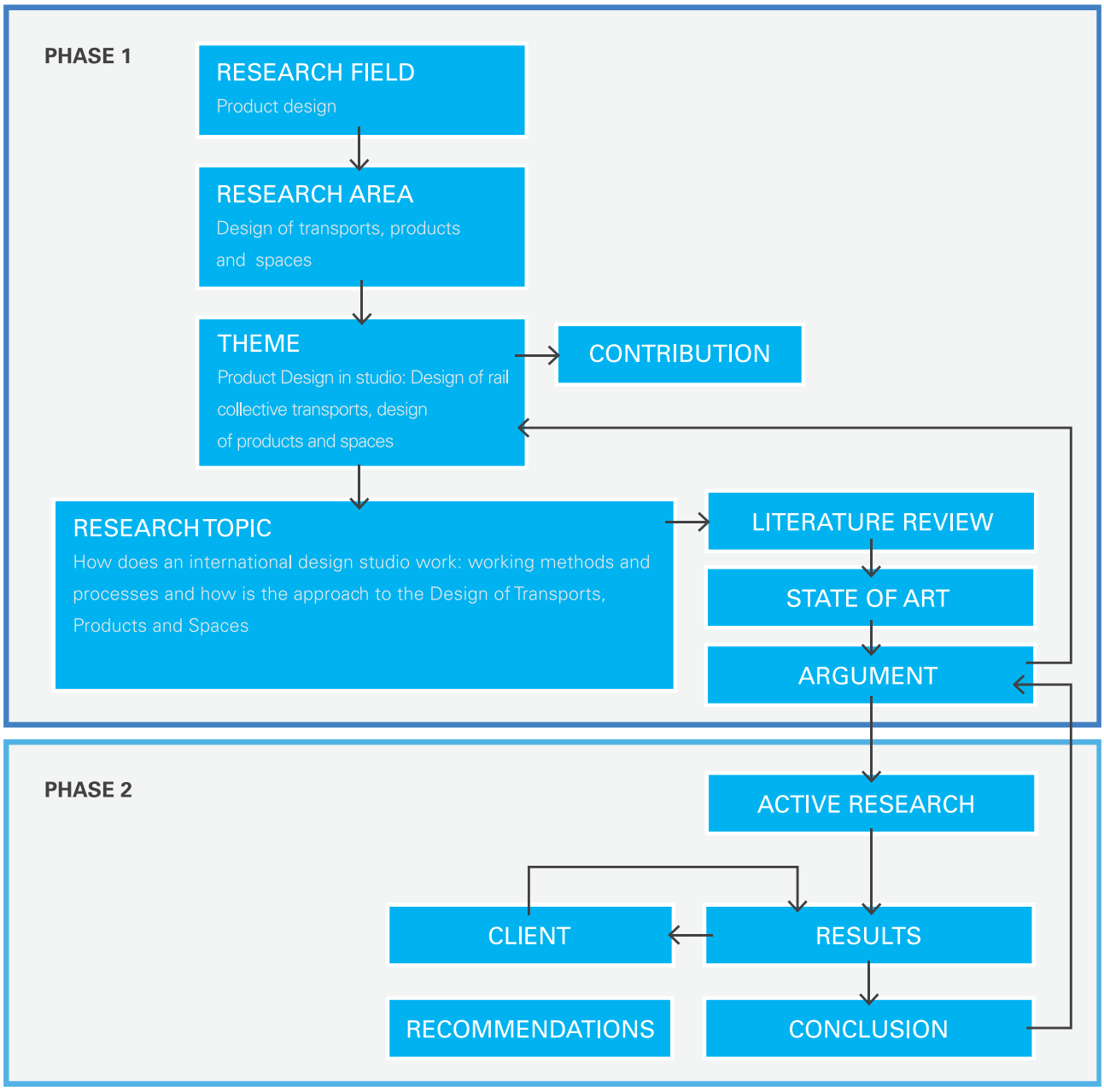


Image.53. Organogram 2014,
Author: Sofia Malato

BENEFITS

This internship brought several benefits: it helped the student crossing the bridge between learning (in university) and doing (in a studio), the intern was able to respond to everyday problems, by participating in the development of ideas that will be produced and implemented in people's lives. It was also possible to work for reputable companies that few inexperienced designers had the chance to work with, alongside experienced senior designers. It was also beneficial being able to experience the working environment within a design studio and to learn about how to ensure a good internal functioning and as well improve the use of software and working speed. Above all, this opportunity allowed to enhance the curriculum, in order to open doors in the future to more job opportunities. In a personal level, it was beneficial to learn a new language and to be able to meet various people from different cultures and backgrounds.

The company benefited from the knowledge of the designer, motivation and commitment. The designer provided assistance in the creative research and in 3D modulation and image editing. The agency also benefited from the native language of the intern.

CRITICAL SUCCESS FACTORS

Above all, the passion for the field of mobility it is advantageous, since it is one of the main domains of the agency MBD Design, this has led to greater commitment and dedication and so to better results.

The agency focuses on the design of products in various areas, in addition to mobility, designs products and spaces, just like the education given in the Faculty of Architecture (FA-UL), which is positive because it allows to respond to a variety of projects. On the other hand, having less experience in the design of rail transports (that is MBD Design main domain) was disadvantageous compared to other interns that are specialized in the field.

The greatest difficulties were the lack of work experience, it was necessary constant training and professional support. Naturally, inexperience brought less productivity at the beginning, particularly in 3D modelling and Photoshop rendering. The project execution time was also a limitation, since a lot of projects were happening at the same time, therefore there was less time to notice details. All work should thus be well organized, and for such, a good methodology and division of tasks must be met, in order to accomplish goals on the stipulated time and also to manage well the ideas. Responsibility and autonomy were also fundamental, as well as the relationship between the various team members.

DISSEMINATION

At the end of the internship, a final report, as well as 1 diary and 2 panels of synthesis were submitted, they were presented at the Faculty of Architecture and subjected to evaluation by a jury composed by 3 elements.

The end result, was not published online for confidentiality reasons, excluding some projects with proper authorization and if the name of the company and location of project it's maintained anonymous).

TIMETABLE

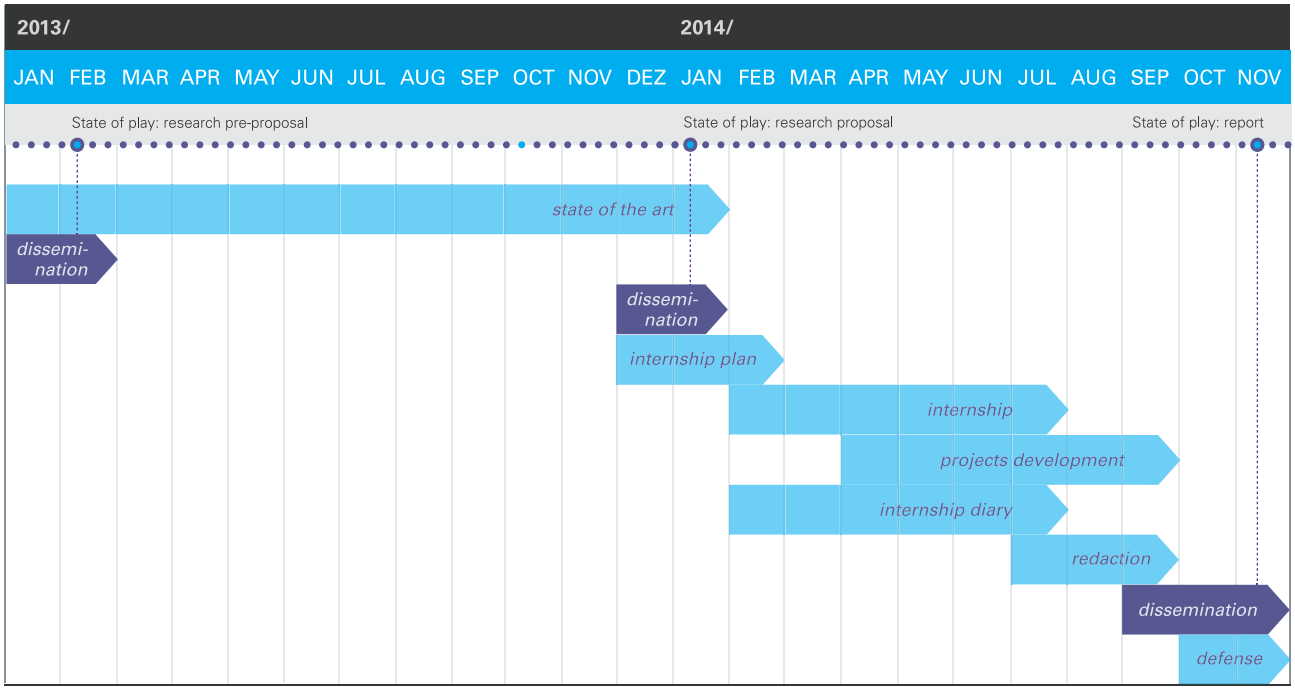


Image 54. Timetable 2014,
Author: Sofia Malato

5. Internship

IMPORTANT: In this chapter some project details such as: name and exact customer location, the project final models, among others details, will not be referred due to a confidentiality agreement. The introduction for each project will contain information based on briefing given by the client.

ABOUT THE INTERNSHIP

An internship it is a very important step to insert a design student in the labour market and should be mandatory in a design education. Nowadays, the recent graduates are increasingly finding it more difficult to enter the labour market, because the more inexperienced someone is, the longer will be the adaptation period and higher will be the costs for the company. With a lower cost, the inthernship, is thus a way to facilitate this integration.

The internship was held in MBD Design agency, located in Paris, for a period of time of 6 months, from February to July 2014. MBD Design has been in business for over 30 years and is a leader in the design of railway transports, but also designs another type of products and spaces.

During the time of the internship, there was the opportunity to participate in several projects, such as: **1.** Design of an information point for an Airport; **2.** Design of a add-on top for a liquid air bottle; **3.** Design of exterior layouts for several rail transports projects; **4.** Design of seats for a train interior; **5.** Design of an air balloon; **6.** Design of an handrail; **7.** Design of a waiting area/shelter for a train station.

This internship allowed to develop a professional perspective different from the former one, especially in relation to the internal functioning and the working rhythm. One of the biggest differences in the working rhythm was the lack of time, which led to a need to perform tasks more quickly and spend less time in details than in a typical academic environment.

The intern designer role in this company, was to work on the creative research and help senior designers performing their tasks. The interns never followed a project completely, from the bigging to the end.

Not all developed projects during this internship were put in this report, because they were less relevant, however, they are referred in the diary.

PROJECTS TIMETABLE

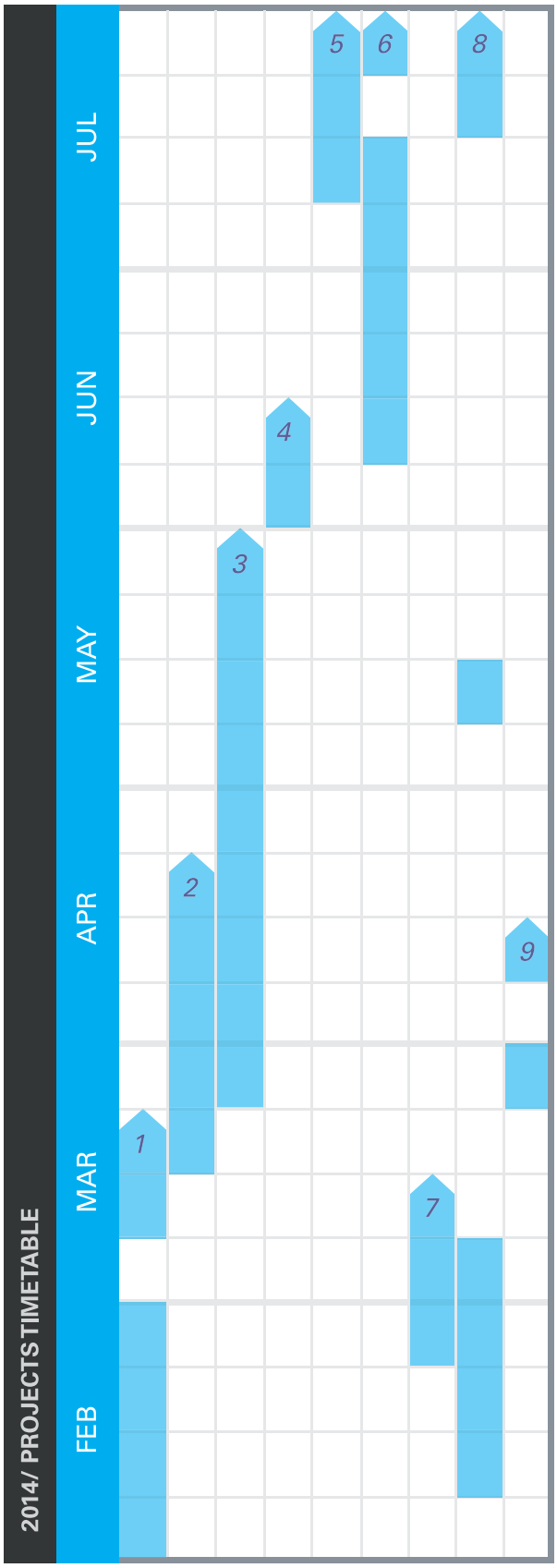


Image 55. Projects timetable
2014, Author: Sofia Malato

MAIN PROJECTS

1. Airport information point

The project consists of improvement and development within the airport facilities, and use of information related to terrestrial transports[1]. The device/ space information developed is composed of three fundamental elements:

1. In the interior of the luggage delivery room, there should be screens above the baggage claim.

2. At the exit of the luggage delivery room, an information panel on terrestrial transports (bus, train, subway...) should be provided.

3. In the arrival zone, an transport information point, gathering a set of resources such as transport maps, ticketing, interactive displays, among others.

The interns worked above all, in studies for point 3. Point 2 was touched upon, and the final result of the information panel was developed by another designer(taking into account each of the different concepts previously developed). Point 1 was not developed by the interns.

[1] Note: This project was started before the arrival to the agency MBD Design. The designers were already developing concept solutions.

Theme

Each team member worked on in their own concepts and took inspirations from other projects when suitable. The project that follows was inspired in the metro map and in the minimalism. Other projects were a representation of simple lines shaped in a squared "U", the final project was having arc-shaped walls with the most salient part at the bottom.

Target

Its target audience are all types of users, mostly adults, both in leisure travel, with or without family, or on a business trip, taking into consideration all the public with limited mobility.

Objectives

Given the points highlighted above, was developed a project that considers the following objectives:

1. The project must have a flexible adaptation to different contexts. It should

be designed to guarantee modularity and adaptability to the surface and dimensional constraints, of the different areas of an airport.

2. This concept of modularity will ensure that each hosting space of transport information, receives the same reception quality, image, environment and ergonomics.

3. The overall design should be part of an *design to cost* approach.

Features

The terrestrial transports information point must have:

1. Transport information details on the wall monitor offering: 1 display with a plan to move to the chosen mode of transport; 1 summary display with the modes of transport available; 1 display listing the main transports to leave the platform.

2. A map of Paris transports with details such as: a display of a medium size map of transport; a secondary plan with links between airports and must display a QR code enabling passengers equipped with smartphone to download the map.

3. An Application on touch screens with information on all available transport to leave the airport, information in how to get to the transport desired (bus / train station taxis) and possibility of printing a roadmap.

4. Space for 4 different ticketing machines.

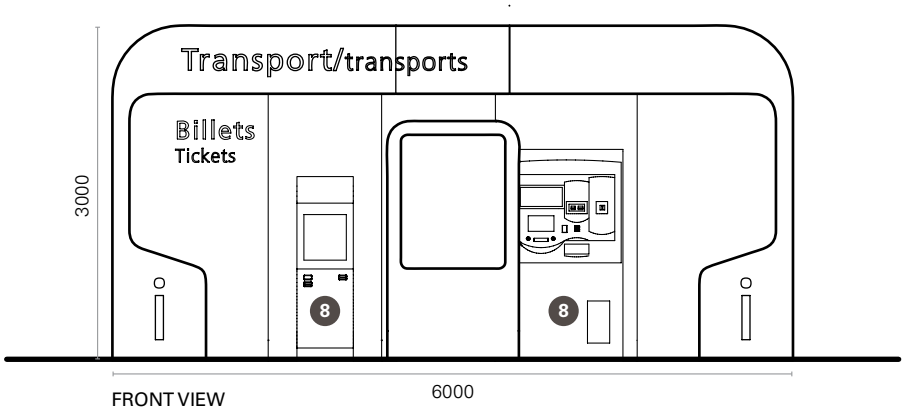
5. 2 different dimensions, a smaller one with 6x2m and a bigger one with 7x5m.

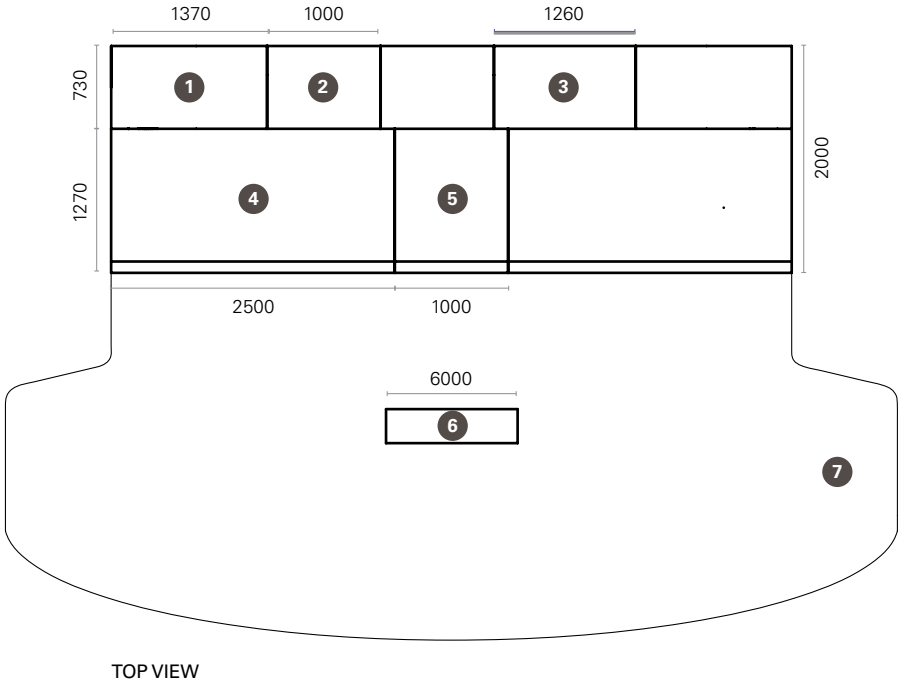
Based on these objectives several concepts were generated, one of which was developed exclusively by the author of this report. The design is inspired by the metro map shape. It's minimalistic style, was inspired by objects such as the Iphone and its curves and clean lines.

Technical drawings

This concept, as the others, was designed in 2 similar versions with 2 different sizes, as highlighted above. All of the modules used on the bigger version, allow to make a smaller one. The bigger information point might be designed simpler, doubling the front line of modules (4 and 5 in 2 lines) making de design straight instead of angular, like this, there is no need to produce the modules 10,11,12 and 13 and the part 9 would be straight as well.

A. Small version front and top view





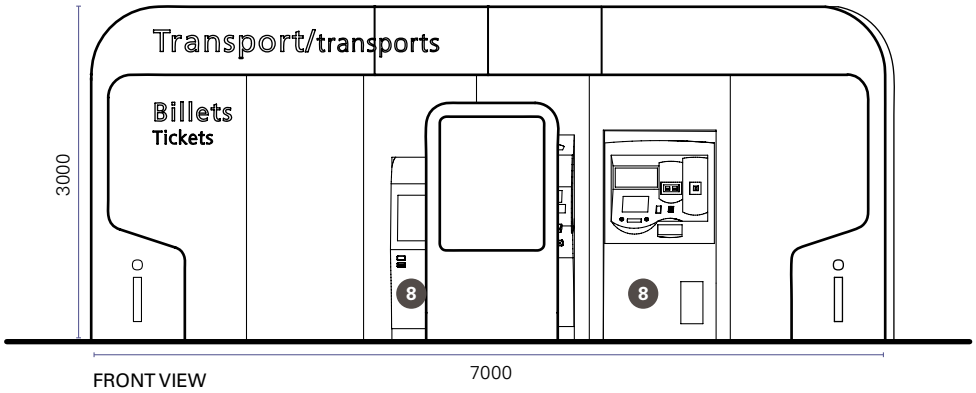
Module 1 x 2 1
Module 2 x 2 2
Module 3 x 1 3
Module 4 x 2 4
Module 5 x 1 5
Info panel on transports 6
Sticker 7
Ticket machine 8

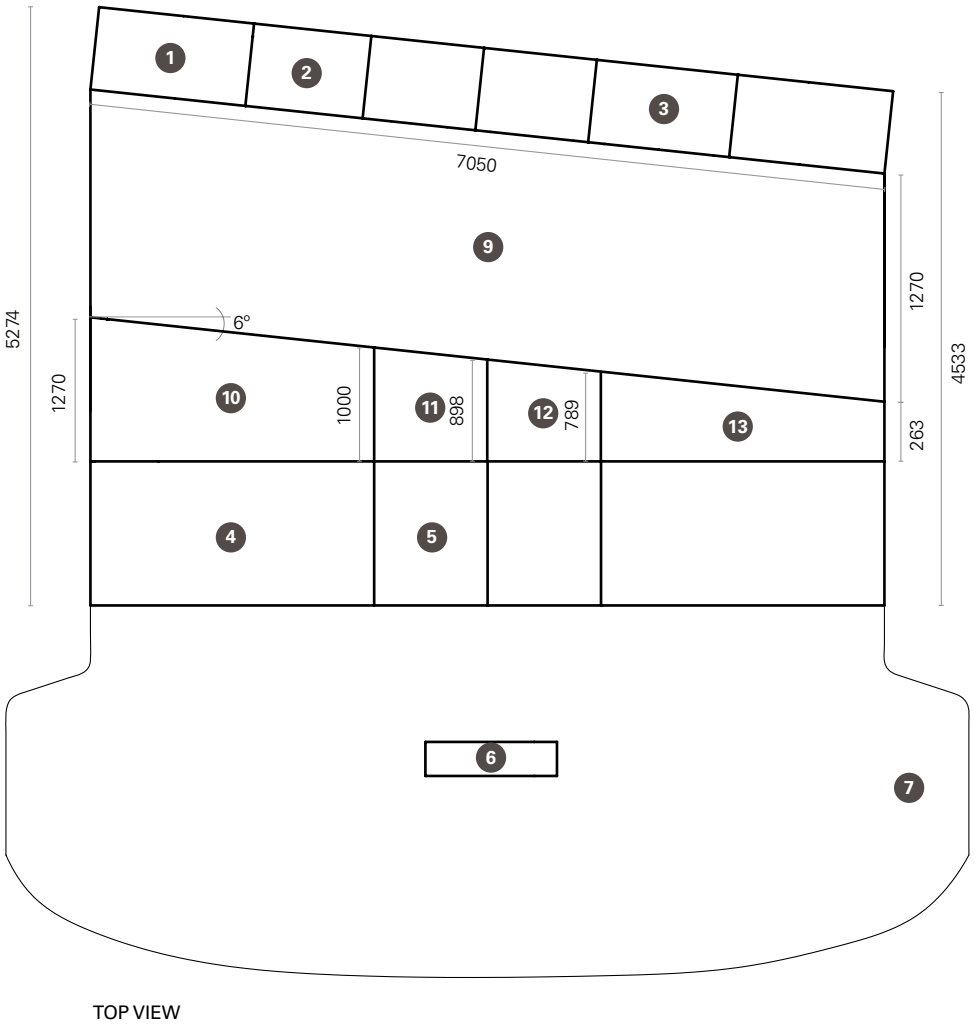
Image 56. Small Info point, technical drawing 2014, Source: MBD Design

Scale 1:75

Units: mm

B. Big version front and top view





Module 1 x 2 1
Module 2 x 2 2
Module 3 x 1 3
Module 4 x 2 4
Module 5 x 1 5
Info panel on transports 6
Sticker 7
Ticket machine 8
Orange translucid polymethylmethacrylate- 9
Module 10 x 1 10
Module 11 x 1 11
Module12 x 1 12
Module 13x 1 13

Image 57. Big Info point, technical drawing 2014, Source: MBD Design

Scale 1:75

Units: mm

Information point final results

1.1. Small version

Both versions have the same information panel at the front (1), the maps (2) are located on the sides, inside and outside, also on both versions. There are 2 touch screens, one in each side, with information on all available transport to leave the airport (3). There are 3 ticket machines, each one belongs to a different transport company. The metro map is a print, the orange sticker on the floor has a similar shape as the front of the information point (5).

The form is simple and clean and is inspired in an I-phone, with straight lines with curved corners, 3 colours where used: the white and orange to respect the airport layout, and wood in some details, to give a more comfortable and eco-friendly look.

Image 58. Small Info point, perspective 2014, Source: MBD Design

1.2. Big version

On this version, there are 3 touch screens, 2 on the left, and one on the right, for a straight and not angular version, it would be possible to feet 4. There are 4 ticket machines, one is repeated. The metro map is no longer a print but a projection of lights, the orange sticker (5) in the images below has a shape of half of a circle, but the previous version is also an option. There are several additional modules including an orange translucent one located in the middle, this orange module transmits an orange environment. The typography used for the signage is the same as the airport: Frutiger LT Std, 45 light e 65 bold.

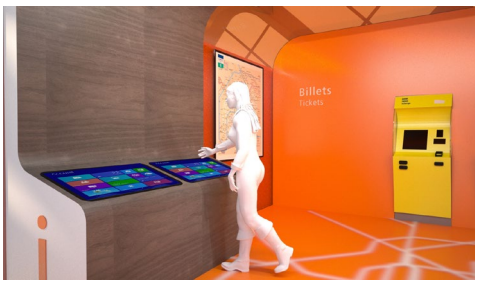


Image 59. Big Info point, detail view, touch screens 2014, Source MBD Design

Image 60. Big Info point, top perspective view 2014, Source MBD Design

Info panel (1)

Map (2)

2x Touch screens (3)

Ticket machine (4)

Metro map print (5)

Metro map projection (6)

Orange translucent (7) polymethylmethacrylate

Image 61. Big Info point, perspective 2014, Source: MBD Design

After the concept development, the proposals were sent to the client who reviewed them and sent feedback, the rest of the design development was taken by the rest of the design team. Interns intervention only happened when help was needed. Later interns were asked to improve the lights of a render made in Maxwell and insert it in a specific environment.

Photoshop rendering

Before (background)

Image 62. Airport background, 2014, Source: MBD Design

Before (render)

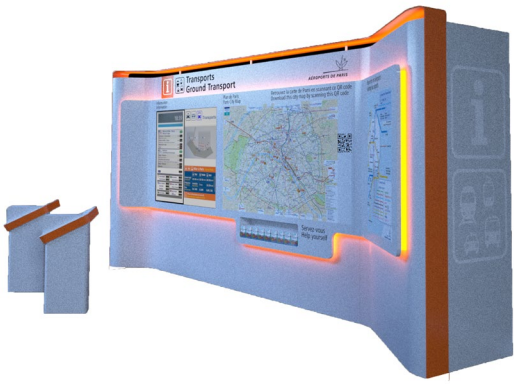


Image 63. Info point render
2014, Source: MBD Design

After (final render compilation)

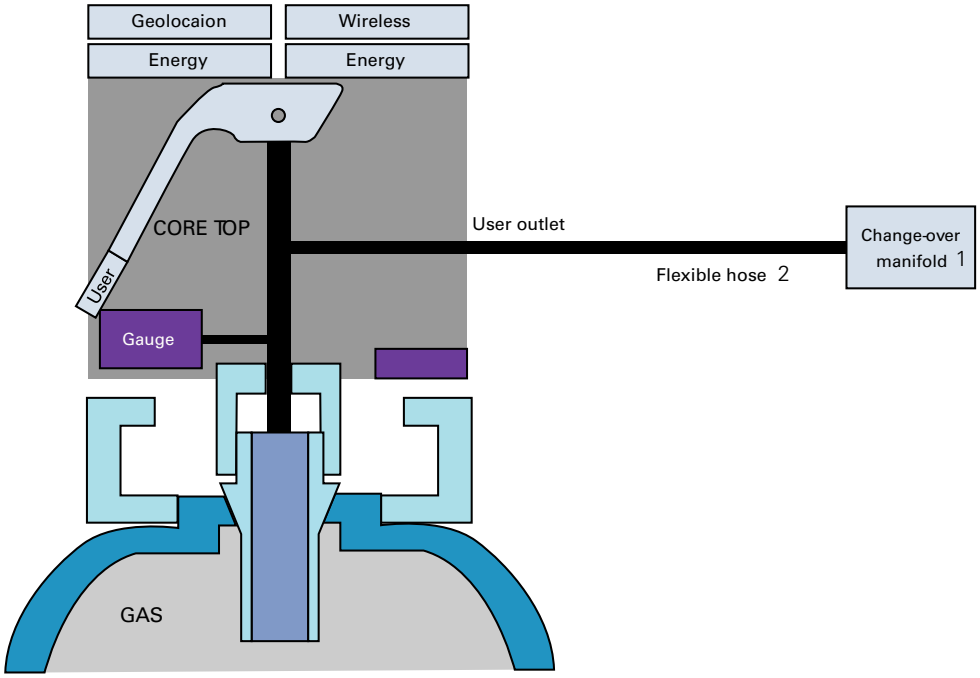
Image 64. Info point Photoshop assembly, 2014,
Source: MBD Design

2. Liquid Air Bottle

The project consists of the development of new add-on tops for bottles of liquid air. Liquid air bottles are used for different types of welding: **Flame:** Oxy-fuel flame; **Arc:** Stick Electrode (SMAW and MMA), Submerged Arc (SAW), MIG/MAG (GMAW), TIG (GTAW) and PLASMA (PAW) and **Light:** Laser. The liquid air add-on top must be design in 4 different versions, with the following characteristic:

Version 1

The simplest top version, the central connection top, is made of: a valve and guard; a HP connection; an on/off lever; a manometer and a gas outlet. The cylinder top is connected directly to a central installation and doesn't move during usage. It is addressed to the smallest customer segment "Focus gas", 4 outlets should be available to connect to optional add-ons.



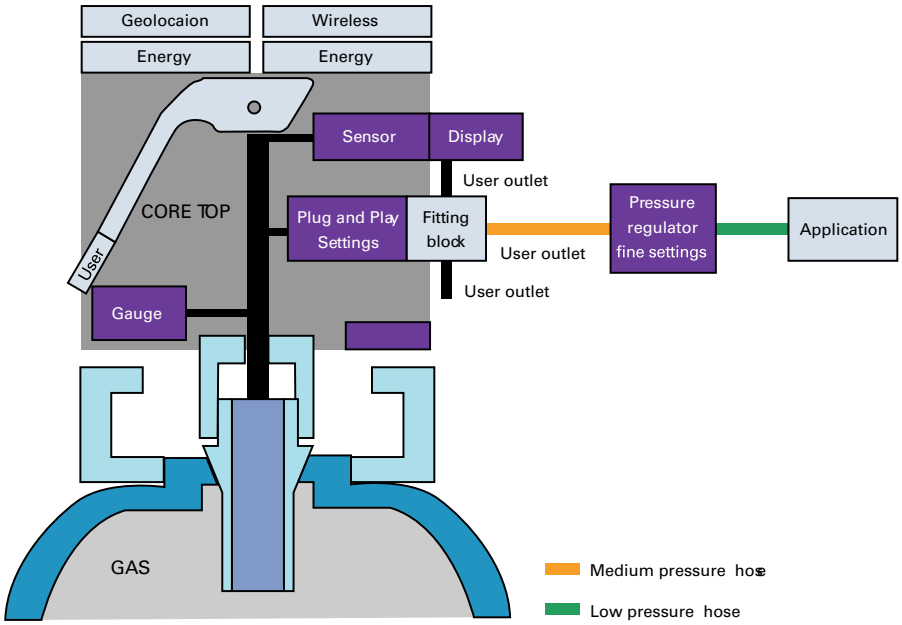
[1] Note: "A changeover manifold is a system of valves and pressure regulators that delivers gas to a process without gas flow interruption" (Gas Equipment Charts & Tutorials)

[2] Note: "A flexible tube for conveying a liquid, as water, to a desired point" (Dictionary, 2014).

Image 65. Version 1 add-on top 2014, Source: Confidential

Version 2

This is the most complete version of the top. AL should be able to easily modify the basic version to add elements to the core top: Remote flow meter with fine tune settings; Integrated fixed plug-and-play regulator; Actuator at distance; Integrated digital screen and could be connected to 2 users. The top is used in welding environment as a remote module on work plan by specialist in his workshop. They are specialists and like innovations (segment "Precision welding").



[3] Note: "Device or instrument for measuring, registering measurements, or testing something, especially for measuring a dimension, quantity, or mechanical accuracy" (Dictionary, 2014).

Image 66. **Version 2 add-on top** 2014, Source: Confidential

Version 3

This is the version 2 adapted to a compact usage in a work site (could be outdoor) with the options: Integrated flow meter with fine tune settings; Integrated fixed plug-and-play regulator and Integrated digital screen.

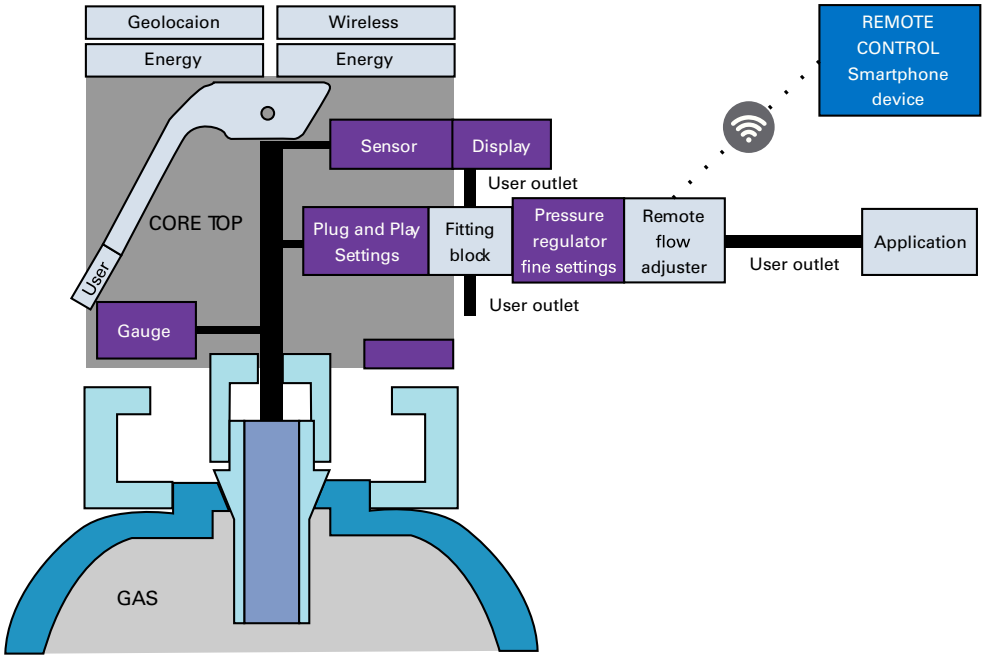


Image 67. **Version 3 add-on top** 2014, Source: Confidential

Version 4

This is the version 3 adapted to very basic usages. The options are: Integrated fixed plug-and-play regulator and Integrated digital screen. The Top used in welding environment in a very compact way in big work site or workshop by temporary workers with low skills (segment "Basic welding". This version is very similar with

the 2nd one, but has no pressure regulator, therefore, has only a low pressure hose.

All 3 interns worked, in the creative research together with other 2 senior designers. The concept designs were sent to the client, there are still no answers about project continuation.

Theme

The design concepts where developed tacking into account the following aspect/theme:

1. Professional/Serious: A design that is simple, clear, functional, safe, easy to understand, it has to be serious so the target can understand the danger of such device.

Target

This kind of equipment it is addressed manly to specialists in welding but also has some models for beginners (simpler works).

Objectives

The new add-on tops should consider the following objectives:

1. Professional and serious look;

2. Quality;

3. Modularity: Components modularity (quick-connect of add-ons);

4. Safety: Should be safe to use and should give a feeling of safety. Top should stop working if there is any potential safety issue;

5. Easy to transport/manipulate: Enhanced ergonomics;

6. Easy to use and understand: Clear design, good use of colours and shapes;

7. Used for more than one user.

8. Confidence (brands).

Features

The liquid air add-on tops must have (some have more functions than others as highlighted above) :

1. A quick-connect TOP: Top is connected to the cylinder (liquid air bottle) via a rapid, one click and high pressure connection;

2. A top/cylinder recognition: Top should be able to identify the cylinder to which it is connected (specific ID);

3. Sensors that measure the content level by user (manometer plus visual indicator);

8. Plug and play settings: User can easily set the proper gas settings by selecting its end-usage on a "handle" positioning system;

9. Fine settings of pressure: Second stage regulator, on top or connected to the top with an extension;

10. A Wireless module that communicates through a sensor information to AL cloud;

11. A gas identification/top colour code in order to identify gas compatibility of the top;

12. A remote module that adjusts flow/pressure remotely from cylinder (via a wireless signal);

13. A visual display to communicate basic information: Digital screen on top allowing user to read several info (remaining autonomy of cylinder, pressure, wireless coverage);

14. Remote settings of pressure/flow: Top should allow the user to remotely adjust the flow/pressure;

15. A Geolocator;

16. A Battery, used to supply power to the various top components;

17. Certification of gas quality, via the wireless module and AI cloud or via gas analyser;

18. A Basic access to a gas certificate via an app on the smartphone;

19. A lock on top for users to be able to lock the top to the cylinder easily;

20. 1 top for more than 1 user at a time, each welder adapting its flow and pressure independently;

21. A support at the top to help moving/carrying the bottle.

Based on these objectives, was reached several concepts one of which was developed exclusively by the author of this report: the design is inspired in medical design products features and as well in kitchen appliances, for its professional layout and simplicity.

Liquid air bottle final results

The following concepts are based on version 2 add-on top. Both versions contain the same functions and style, only the shape is thinner on one than in the other. The Shape is simple, clear and serious, features are easy to locate and use, the geolocator,

batteries and wireless modules at the top, are identified with a symbol and separated from the rest of the technical components. In case of damage, maintenance and replacement of parts is simple. To reach the technical components inside, you must firstly remove the top part, then you remove the screws located on the part to place hands, then finally, the 1st third of the add on top is removed. The digital screen allows to see remaining autonomy, pressure and wireless coverage. The add-on tops have a quick system to remove, attach and secure: Hands have to hold the part that goes inside, the fingers are placed down on the gray part and the thumbs press the upper part. When you press down, the safety lock is released, allowing to insert or remove the add on top. There is an indication on the top for the thumbs placement.

The design lines are a mix between straight, angular an curved lines. This style is adopted in medical design and household appliances, with simple pure and minimalistic shapes.

The colours used were: Red, for more important features such as the on/off lever and the on/off screen button, red is a colour that incentives action and gives a feeling of security; Blue represents calm, confidence and security, it's a colour that stimulates productivity (Carvalho, 2013); Grey is a neutral and serious colour that combines well with other colours, specially blue.

Image 68. Larger liquid air bottle perspective 12014, Author: Sofia Malato

2.2. Thinner version

Lock/unlock knob (1)

User outlet (2)

Digital manometer (3)

Pressure regulator (4)

Liquid air bottle (5)

On/off lever (6)

Image 69. Thinner liquid air bottle perspective 2014, Author: Sofia Malato

Image 70. On/Off lever 2014, Author: Sofia Malato

Detail

Location for thumbs (7)

Geolocator (8)

Wireless (9)

Battery (10)

Image 71. **Top detail view**
2014, Author: Sofia Malato

Other companies/agencies were competing for this project. The concept designs, were sent to the client but the client chose another agency for the project continuation.

03. *Tram exterior for China*

The project consists in designing 10 final designs of the exterior of a tram for China, the brand already has a style of trams pre-made so it is only necessary to design the front/face. The creative research was performed by the 3 interns and other senior designer. The studies were made by sketching on paper and Photoshop.

Theme

The design concepts where developed taking into account the following aspect/theme:

1. Nature and Ecology: 3 designs with this theme. the design will be inspired in natural or biologic shapes like plants and animals, in order to show a tram with a green style.

2. Modernity: 5 designs with a simple, elegant, harmonic and distinct design congruent with the public aesthetic demands. There are some important elements in this theme:

2.1. Geometric form, especially the oval and rounded shapes;

2.2. Comfortable and pleasant environment;

2.3. A design that is trendy, elegant and with rich detail.

3. Classic: 2 designs that should be singular and original in order to show the culture and the humanity of the brand,it should give an idea of durability and should respect the brand typical design lines.

The quantity of the designs created doesn't match the numbers above due to the fact that it was a work performed by more than one designer. MBD Design asked to design using previous rail transports developed by the agency as inspiration.

Target

Its target audience are all types of users, both in leisure travel, with or without family, or on a business trip. The target nationalities will be manly Chinese, so it is important to take into account the target culture in the designs.

Objectives

A variety of distinct and original designs, the level of rendering quality asked by MBD Design was simple without to many details.

Creative research

The following concepts were developed by the intern based on the concept directions presented above. All interns worked together on this subject and met occasionally to compare the different results. The support used was initially sketching and after Photoshop.

1. Nature and Ecology

1.1. Organic shape, inspired by a boat like the Marseille tram and on the one model of the tram Flexity, both designed by MBD Design. The front also gives an idea of a smiley face, a "happy tram", very common in Chinese culture.

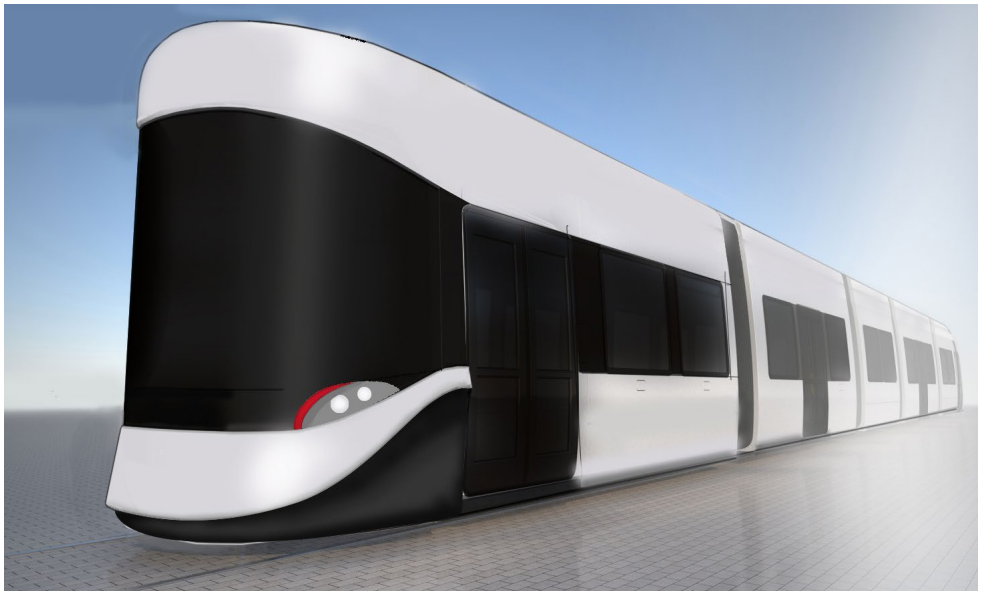


Image.72. Natural tram1
2014, Author: Sofia Malato

1.2. The shape has rounded corners, tacking as inspiration the aquatic animal world, more precisely a fish. The "face" is neutral.

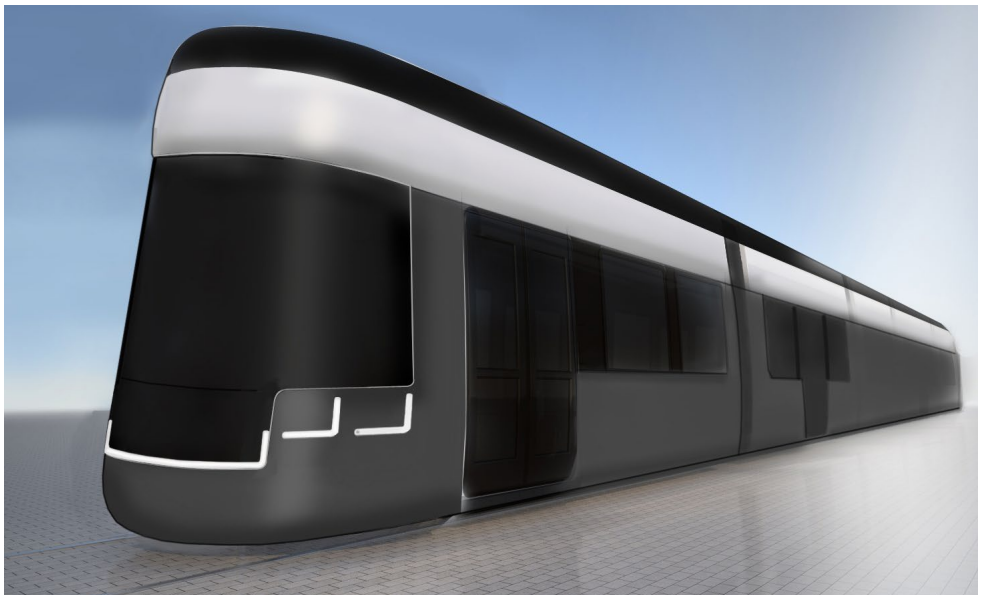


Image.73. Natural tram 2
2014, Author: Sofia Malato

2. Modernity

2.1. The shape has rounded corners, with soft curves. The front is straight, the glazed surface is big, the headlights are rectangular and they are slightly inclined. The overall shape is simple, geometric and clean. The metallic surface is reflective, it reflects the surrounding environment allowing a good integration.

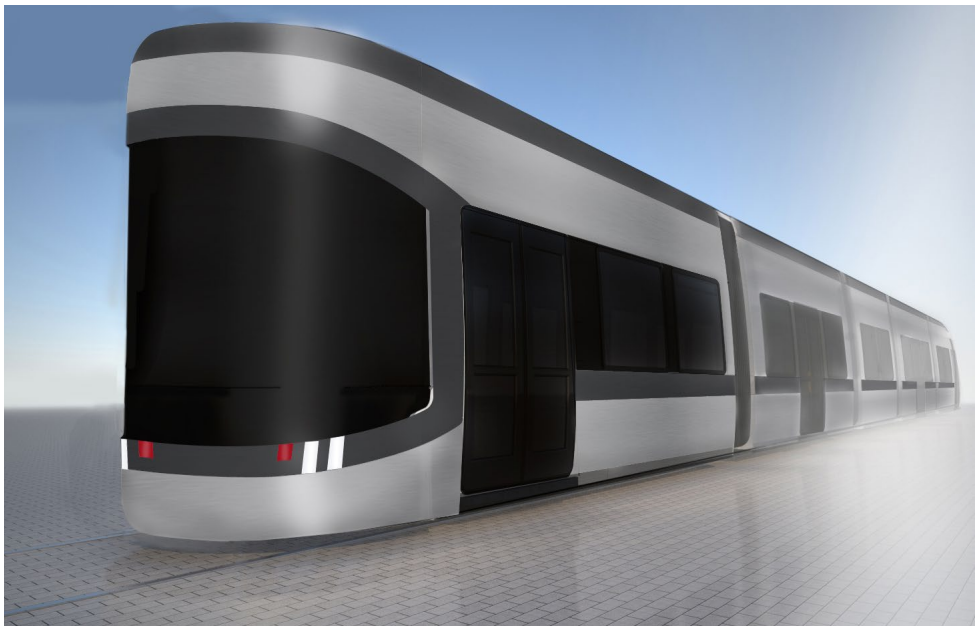


Image.74. Modern tram 1
2014, Author: Sofia Malato

2.2. The shape has rounded corners on the top and bottom, the front is slightly inclined, the front glass has a mix of straight lines with soft curves surrounded by LEDs all around, the lateral windows and doors are also surrounded by LEDs. The headlights are simple circles. The overall shape is simple and minimal with few details.

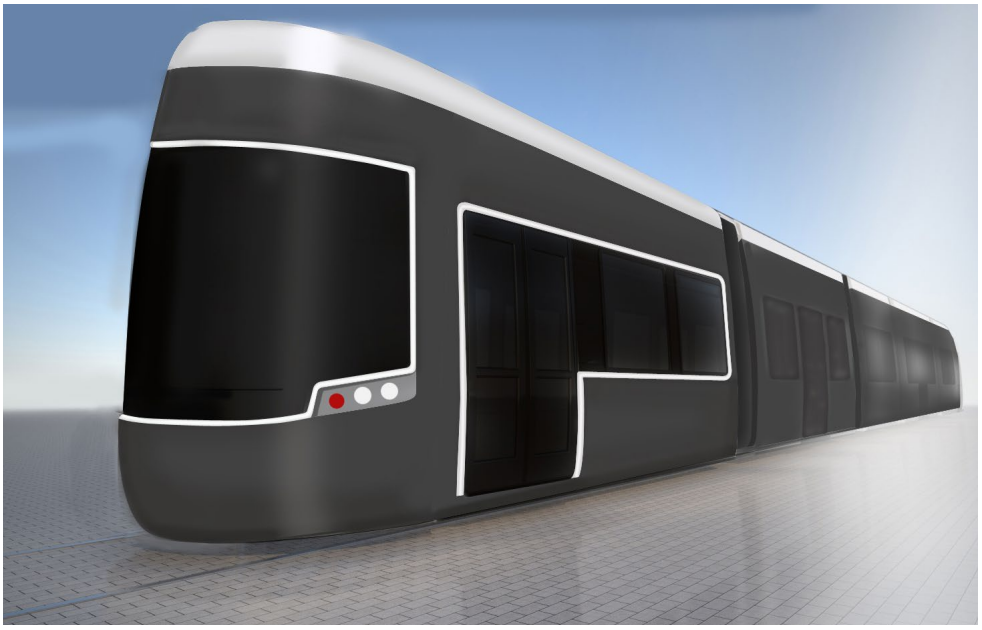


Image.75. Modern tram 2
2014, Author: Sofia Malato

2.3. The front has a cutout design, the edges are salient and wavy, the bottom is more rounded, the headlights have both curved and straight lines forming an eye shape. The front glass is slightly concave. The overall design is harmonic, minimalist, modern, simple and clean.

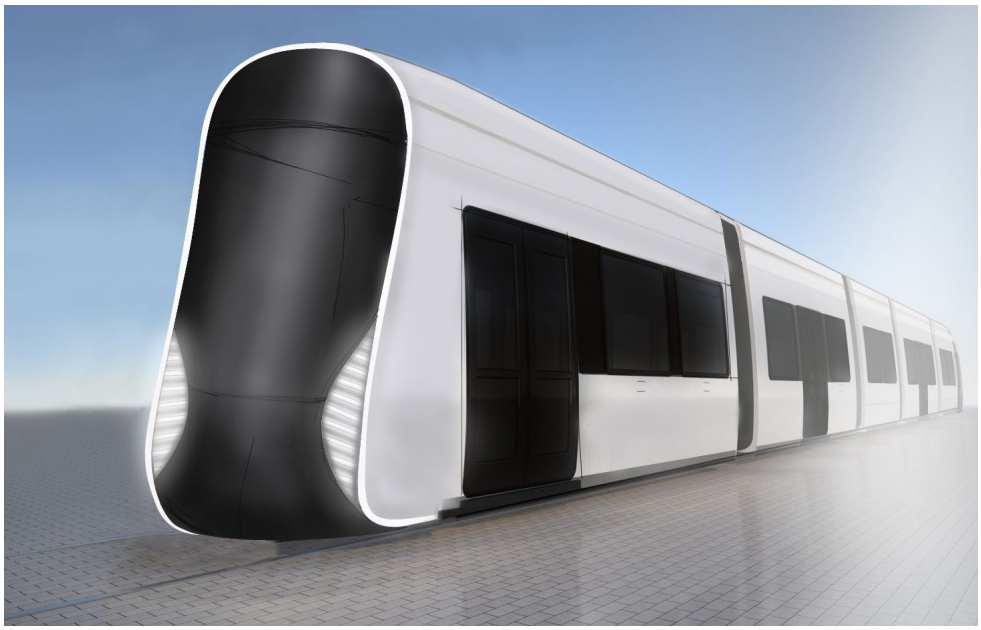


Image.76. Modern tram 3
2014, Author: Sofia Malato

2.4. The design is inspired in the tramway of Tours. The front is thin, curved and with salient edges similar to the previous design. This time the curve is not a wave but an arc. The headlights are also similar. The overall shape, is harmonic, geometric, minimalist, modern, simple and clean. The sides have an aluminium surface.

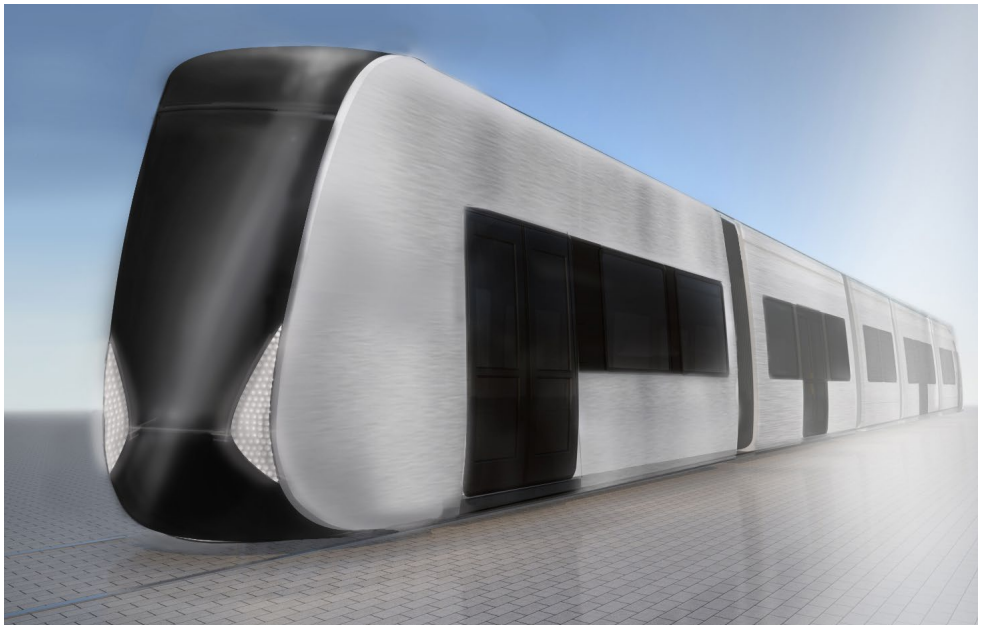


Image.77. Modern tram 4
2014, Author: Sofia Malato

2.5. Has a geometric shape, this time, there is a predominance of straight lines. The front glass is slightly concave and has a hexagonal shape. This design is more dynamic and complex than the previous ones, the headlights are small and triangular.

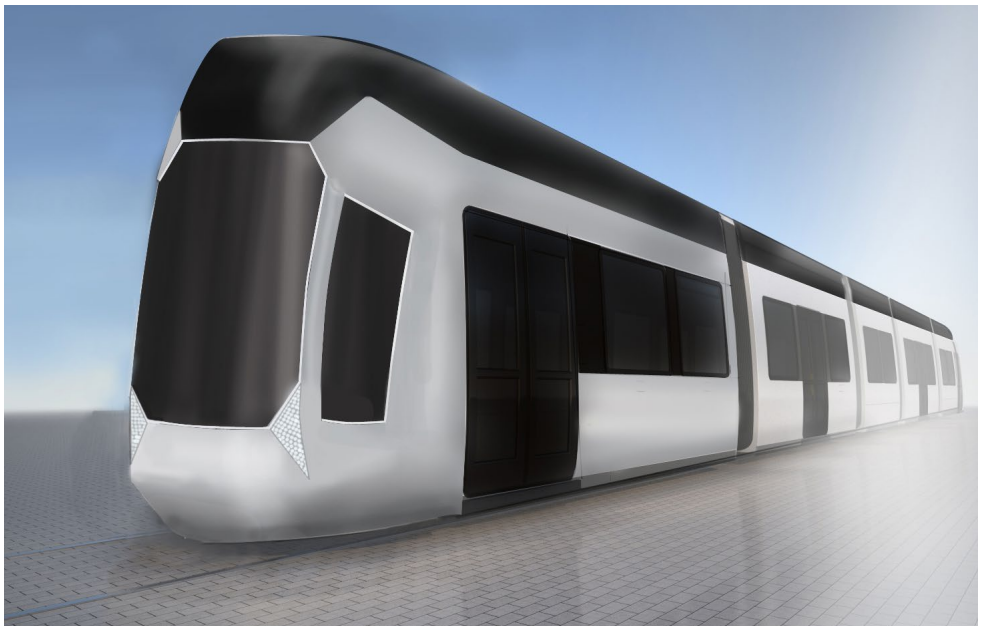


Image.78. Modern tram 5
2014, Author: Sofia Malato

2.6. Again, a geometric shape with both curves and straight lines can be observed. The Front glass has a concave hexagonal shape, the top and bottom edges are rounded and the headlights are shaped as an eye. This tram has simple lines and a soft smiley "face".

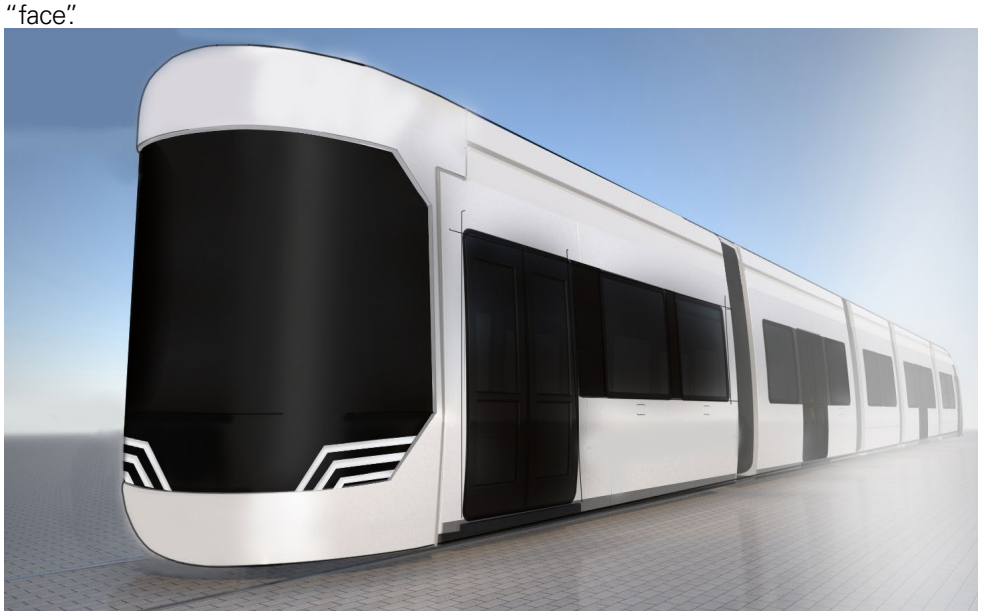


Image.79. Modern tram 6
2014, Author: Sofia Malato

3. Classic

3.1. This design is inspired in previous models developed by the client, therefore its design is classic. This model has natural/organic shapes, a concave front glass, a rounded bottom and rhombus shape headlights. The front glass, windows and doors have a white band all around. The overall design is elegant with simple lines that form a complex mix of shapes.

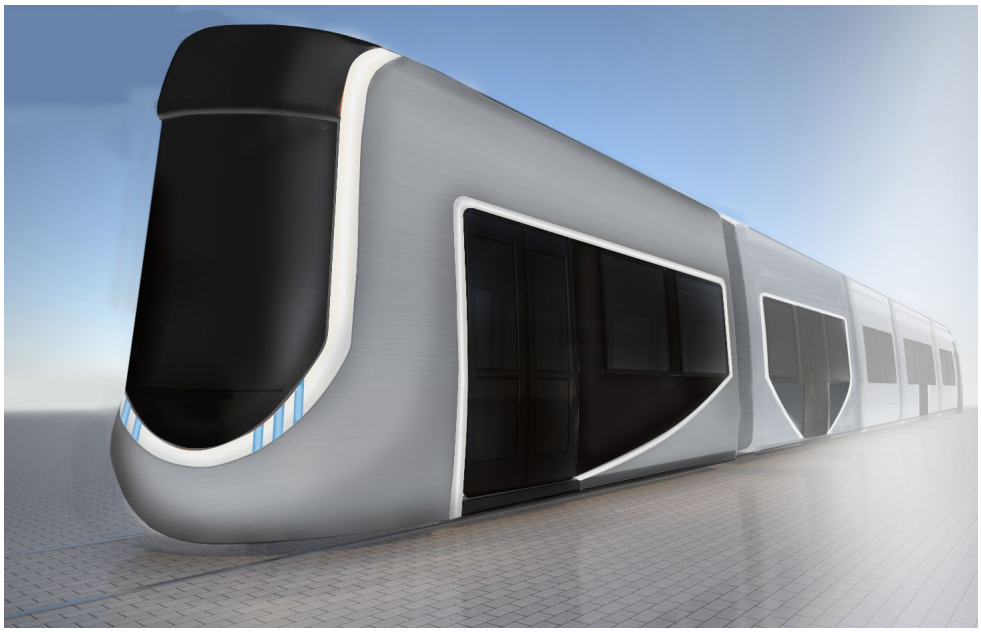


Image.80. Classic tram 1
2014, Author: Sofia Malato

3.2. This design it is also inspired in previous models. The front is more inclined than the previous designs, this gives an idea of dynamism and speed (even though it is not the case). The front glass narrows up as it descends and has small headlights at the end. There is a triangular window (with rounded corners) on the side.

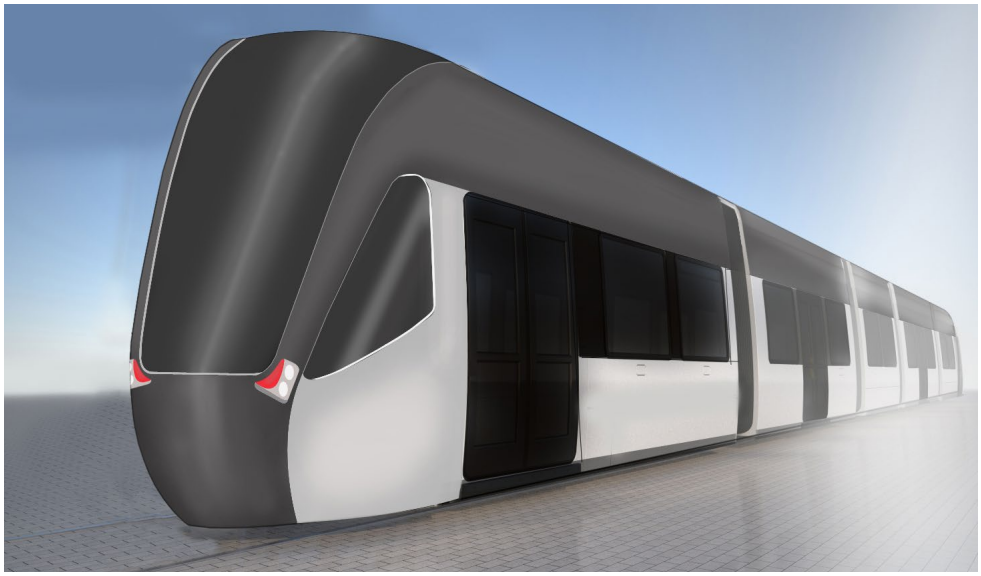


Image.81. Classic tram 2
2014, Author: Sofia Malato

4. Renovation of facilities within the metro and train stations

A. Handrail

The staircase is a strong architectural element, and has always had a special value for architects and designers. Its presence, has an important role in a public space. The project was centred around the development of new handrails in new and existing metro and train stations staircases both outdoor and underground. The client will rehabilitate the staircases of the train and metro stations by making specific accommodations for handicapped people, which will recognize recognise cognitive, sensory, technical and ergonomic aspects. The creative research was performed by the 3 interns.

Theme

The design concepts where developed underlining tacking into account the following aspects/themes:

1. Sensory experience: Guidance on stairs using visual and tactile experiences such as: the feeling of first contact (texture, temperature); Induced feeling of security (in the different phases of usage); visual cues that prepare the user to breaks in moving; measures to ease and secure the use for any person with a permanent disability.

2. Functionality during different phases of usage: Stairs must first and foremost be safe, and each stage of usage must consider the moment requirements: In the approach, gripping (uphill or downhill) and exit (the "drop")

3. Critical interface: An angular position or geometric particular system, can lead to a difficulty of resolution. The new handrails should meet 95% of the most common installations.

4. Dramatization: Aesthetically pleasing by observing a beautiful object with enjoyable tactile sensations. The French tradition of ornamentation, may also be used.

Target

All type of users, from children to adults and elders including handicapped people. Its shape and aesthetics must suit the majority.

Objectives

The new handrails should consider the following objectives:

1. Aesthetics: Connection between design and historical and traditional elements of the city (subway).

2. Security: Equipment should allow to visually guide and anticipate the path in order to avoid accidents. Where appropriate, lighting of some stairs should be enhanced;

3. Consistency: With the different types of spaces (new and existing);

4. Functionality

5. Modularity

Features

The new handrails should equip the staircases of train stations in the city (one city in France), to best meet the constraints of accessibility. The following range of handrails should be considered:

1. Single Handrail

2. Double handrail (2 heights)

3. Lightened handrail

Based on these objectives, was reached several concepts one of which was developed exclusively by the author of this report: the design is inspired by classical and Art Deco style.

Handrail final results

The model below is a double handrail with LEDs incorporated, it can be adapted to a single handrail by removing the lowest handrail. Its shape is simple and the curves are gentle, the handrail gives both warm and cold tactile and visual experiences. The design is a mix between modern and classic; wooden handrails are classic, add a traditional element to a stairway, and can also be strikingly modern-especially when combined with materials such as metal, glass or incorporated LED lights. Metal handrails with horizontal bars evoke the clean lines and curves of Art Deco style. Clean and neutral colors and materials allow the design to shine and at the same time to well integrate in most of backgrounds.

Image.82. Train station handrail 2014, Author: Sofia Malato

Image.83. Handrail detail 2014, Author: Sofia Malato

B. *Waiting areas for train station platforms*

Within this project, we created a new range of exterior waiting cells on the platforms of the train station. As a modular device for sheltering travellers, protecting them from unpleasant weather conditions, the shelter should be adaptable to the architectural configuration of the railway stations.

The creative research was performed by the 3 interns.

Theme

The design concepts where developed tacking into account the following aspects/themes:

1. Object expression: Censorial experience both visual and tactile.

2. Magnify experience: Make use of the shelter for more than just a temporary protection by creating a pleasant, joyful and creative design;

3. Climate adaptability: Shelter that adapts to different climate changes (seasonal).

Target

All type of users, from children to adults and elders including handicapped people. Its shape and aesthetics must suit the largest possible number of people.

Objectives

The new waiting areas/shelters should consider the following objectives:

1. Integration: A good integration on the existing train station (aesthetics);

2. Modularity;

3. Easy to use and understand: Management of the opening / closing of the shelter (for enclosure, ventilation and protection against any type of weather;

4. Flow management: Respect to movement flow on the platform.

Features

The shelter must have:

1. Variety of services: Such as a TV screen with transport information, advertisements, entertainments, among others;

2. Seats;

3. Wind and rain protection.

Based on these objectives, 2 concepts were reached which were developed exclusively by the author of this report: Both designs are inspired in visual and tactile experiences and in a mixture of geometric shapes and organic lines.

Waiting area final results

1. Oval

This concept of shelter, was designed in 2 versions, the same design but with different materials (plastic and wood) and a different size of "window shades"[4].

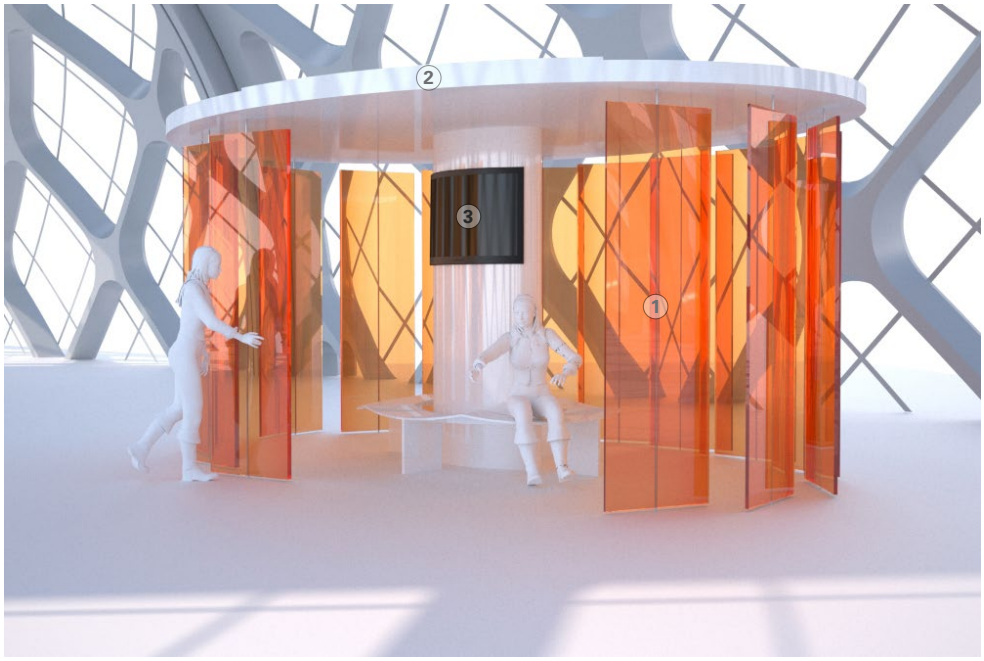
[4] Note: Horizontal plates that open and close to let more or less light enter and to protect from the bad weather.

The shelter has an oval shape, the bigger diameter has 6200mm the smaller 4376mm, the roof is parallel to the floor, one "slice"/"triangle" of the oval roof, the one of the entrance, is higher in order to protect people from the rain. The window shade is composed by 59 (212mm wide) horizontal plates/boards for the wood version and 15 (765 mm wide) for the plastic version. The plates/boards are sustained by a metal tube that is attached from the roof to the floor. The shelter is also adaptable to different weather conditions, the "window shade" can be adjusted from the inside and outside. The roof is sustained manly by an oval column at the middle but as well by the metal tubes. The shelter has a wavy chair disposed around the central column. The column also has a convex curved screen attached on, the screen can be replaced by a strait one instead. Inside the shelter is possible to seat 5 people, 12 more, can stand inside comfortably.

The design lines are simple and contrast between curves and strait lines. Most train stations in this city use both geometric and curved (manly on the roof) shapes, the creation of a design that implements both curves and rectangles allows a good integration.

It is inspired in censorial expressions by use of contrasting colours and its projection of coloured light and by the tactile interaction between users and the design objects. Modularity is as well one key topic for this design. This design it is an incorporation of new in old and results in a pleasant and joyful waiting experience.

The colours used where: white and wood for one version and white and translucent orange for the other. White is symbol of simplicity, cleanliness and peace, therefore, it blends well with all the other colours. Wood has a colour of nature, the earth, simple, neutral and comfortable. Orange it's a balanced colour, vibrant and full of energy, it's as well friendly and inviting (Carvalho, 2013). The orange of the plates/boards reflects into the floor creating an orange environment.



Window shade plate (1)

Rain protection (2)

Transports info (3)

Bench (4)

Image.84. Oval orange shelter

2014, Author: Sofia Malato

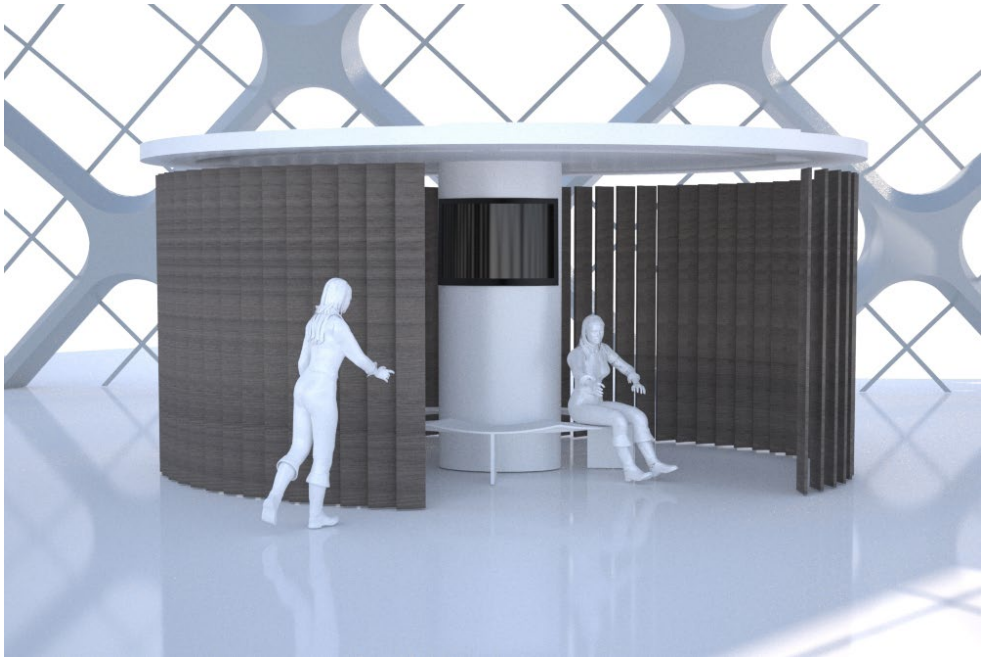


Image.85. Oval wood shelter

2014, Author: Sofia Malato

2. Wavy

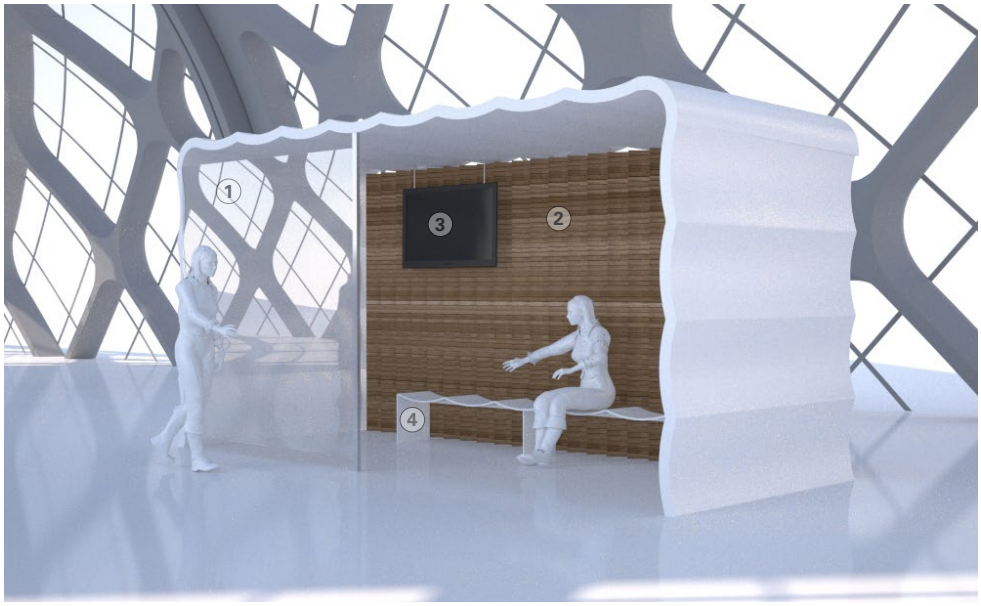
The shelter has an rectangular shape, the roof is slightly inclined, higher at the front, in order to protect people from the rain. The window shade is composed by 24 (216mm wide) horizontal plates/boards the plates/boards are sustained by a metal tube that is attached from the roof to the floor. As the previous design, this shelter is also adaptable to different weather conditions .The window shade is located backwards and can be adjusted from the inside. There is glass in the front "wall" covering only a part of the entrance, like that is possible to be seated or

standing in an open space or in a closed one, this glass is sustained by a metal tube and it is attached to the wavy surface. Inside there is also a wavy chairs, similar to the previous one but extended in one straight line and a screen with information on transports. Inside the shelter it is possible to seat 5 people, with space for 8 more to stand inside comfortably.

The design lines are a contrast between straight and curved lines as the design before, however this curved lines are concave and convex, like waves. As the design above the combination of curves and rectangles allows a good integration in the train station.

It is inspired in censorial expressions both tactile and visual, in simplified gentle organic lines. This design it is discrete simple and clean, it is inviting and comfortable.

The colours used were the same as one of the previous versions, the one in white and wood.



Glass wall 1
Window shade 2
Transports info 3
Bench 4

Image.86. Wavy shelter perspective 2014, Author: Sofia Malato

Image .87. Wavy shelter front 2014, Author: Sofia Malato

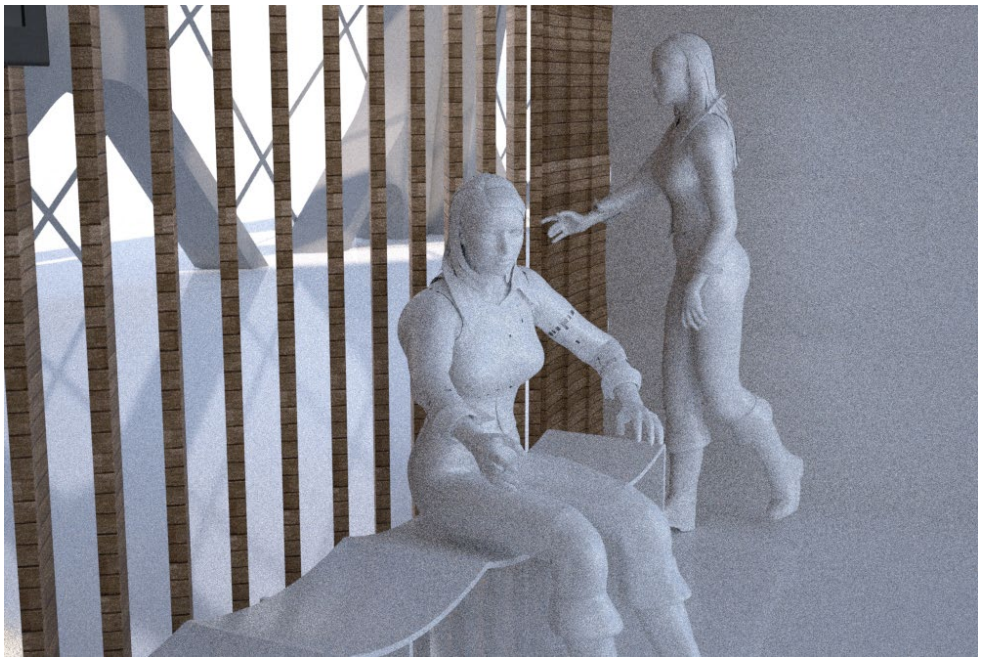


Image 88. Wavy shelter detail 2014, Author: Sofia Malato

5. *Tethered balloon*

A tethered balloon or, according to the American Government Accountability Office (2012), an aerostat, is restrained by a cable attached to the ground or a vehicle and so cannot float freely (Wikipedia, 2014). It is used for atmospheric and weather observations (U.S. Senate, p.30), for instrumentation or communications equipment platforms, for civil or military use (Wikipedia, 2014).

The briefing for this project was given verbally by MBD Design CEO, so only the essential information for this project development was given. The information given detailed aspects such as: Size, shape, desired colours and necessary features.

The main purpose of this project was to improve an existing model and make it in 2 different sizes, one with 25m long another one with 10m long. The original product -presented below (images 84 and 85)-has its wings attached in the rear with the technical box hanging below the balloon by ropes. The red ropes below, squeeze the balloon by creating a deformation in the general form.

Small tethered balloon features

The new improved aerostat should have:

1. Size: 25m long per 7m wide;

2. Colours: Main body in translucent white, wings in blue;

3. Wings: Incorporated in the balloon

4. Technical box: Incorporate 2 technical boxes, inside the balloon in a way that can be removed easily from the outside, like a pocket. The technical boxes should be disposed side by side, the 1st is smaller. The technical boxes should have: 2 cameras and 2 lights, green and red, one in each side (in the 1st box).

5. Handles and support for ropes: Handles to help carry the balloon when it is on land and they should have incorporated some holes to hold the ropes.

6. Overall shape: The shape can not differ much from the original because of aerodynamic constrains, however it can be improved by simplifying the curves, improving the end and removing the deformation.

Big tethered balloon features

The new improved aerostat should have:

1. Size: 10m long per 4m wide;

2. Colours: Main body in white, wings in red;

3. Wings: Incorporated in the balloon

4. Technical box: The technical box should be located outside the balloon and it should have: 1 camera and 2 lights, green and red, one in each side.

5. Handles and support for ropes: The same features as the big version.

6. Overall shape: The shape has the same features as the previous just a different size.

Original model:

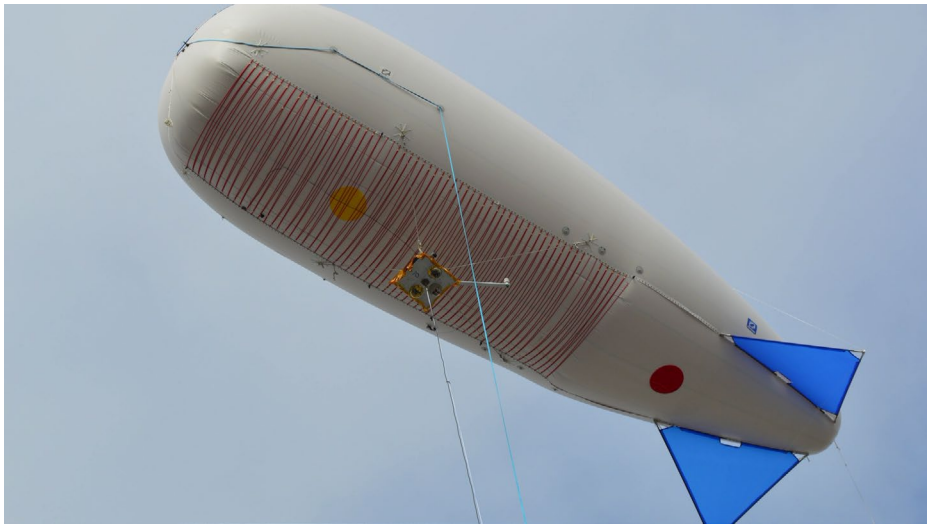


Image 89. Original tethered balloon air view 2014, Author: Confidential

Image 90. Original tethered balloon in land 2014, Author: Confidential

Final model:

The smaller aerostat looks more bulky in comparison to the bigger one as it is longer. This project had a lot of technical constraints, so the new developed model is more functional as opposed to creative. There was preference for a simple and geometric shape of wings.

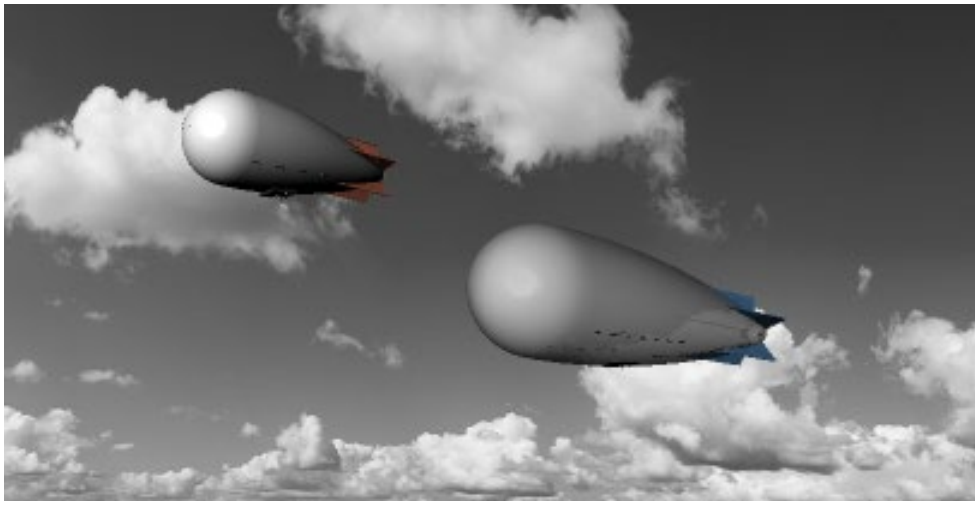


Image.91. Tethered balloons air view, 2014, Author: Sofia Malato

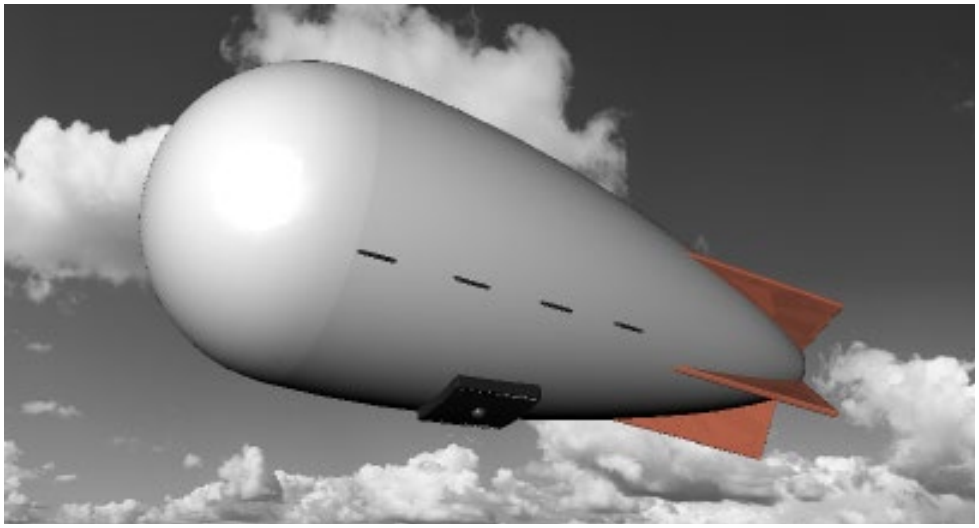


Image 92. Small tethered balloons air view, 2014, Author: Sofia Malato

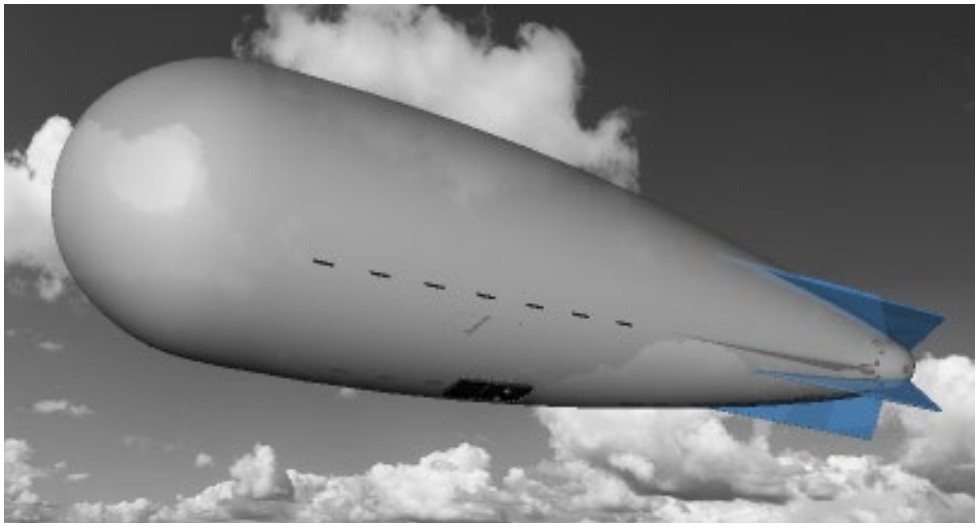


Image 93. Big tethered balloons air view, 2014, Author: Sofia Malato

Technical box (1)
Camera (2)
LEDs (3)

Image 94. Small tethered balloons box, 2014, Author: Sofia Malato

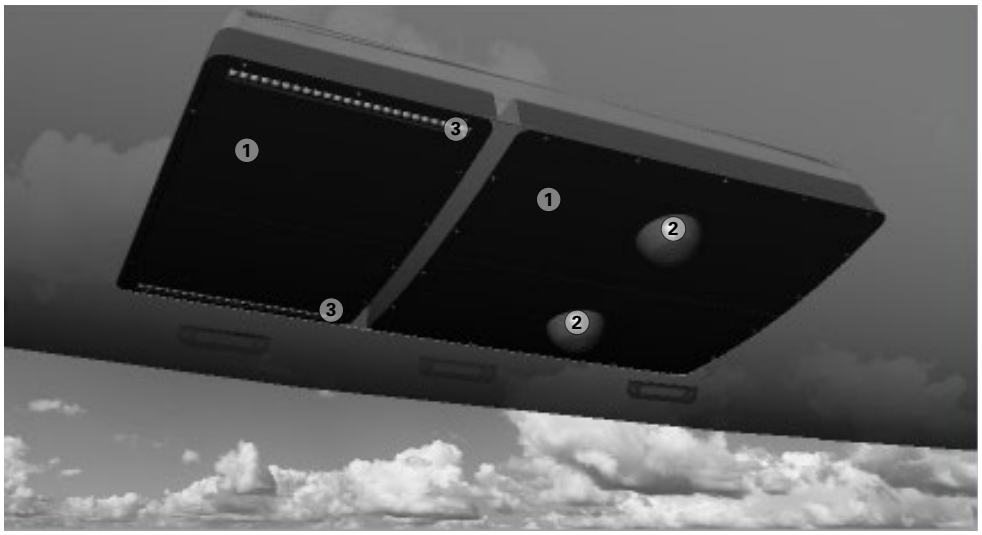


Image 95. Big tethered balloons boxes, 2014, Author: Sofia Malato

6. *Interior train design*

The briefing for this project was given verbally by MBD Design project manager. So, only the essential information for this project development was given. Information like: Themes and features (basic ergonomic features are the same in all trains). The main purpose of this project is to create a new innovative concept of train interior, for a city in Austria, focused on the user and its needs, both leisure and comfort.

Theme

The design concepts were discussed with the team developed underlining tacking into account the following aspects/themes:

1. Vitality floor / Tranquillity floor: so that the user can choose the type of environment that suits him the most. A tranquil environment should be clean, pure, simple, spacious, minimalist, intellectual, with ZEN colours and should allow isolation. A space with vitality should bring energy, joy,should be colourful and should stimulate interaction between people. It was given as examples some projects already developed by MBD Design**;**

2. Waistband: a platform with 620mm of height that is cut in order to form seats and tables, like a waistband bypassing the carriage inside;

3. Collective/individual: contrast between collective individual spaces, the train should provide both environments in order to please the different types of targets;

4.Cognitive ergonomics: a train with a different approach, with organic lines that move intuitively along the vehicle;

5. Band window: play with the window shapes and give an idea of continuation;

6. Stairs enhancement;

Target

Its target audience are all types of users, mostly adults, both in leisure travel, with or without family, or on a business trip, taking into consideration all the public with limited mobility.

Interior train final result

Some of the themes referred above were developed, however, the chosen approach was the number 4, intuitive ergonomics. The images bellow represent a simplified conceptual study for a 1st class carriage, the set of chairs still have few details and there are no tables. The purpose of this concept is to contradict the traditional chair distribution in most of trains existing today, like this, the corridor instead of a straight line will be slightly wavy. The seats are disposed along a curve (a cut circle), the space between the chairs in the same set, works like a table, luggage can be tidy bellow the chair.

The overall shape is simple, clean and tranquil, the illuminated top gives a modern touch, while the wood gives a classic touch also raising an idea of comfort. This design could be improved by making the following changes: improve the curve of the backrest; increase the thickness of the upholstery; make less aggressive edges; do the armrest movable; add details like a garbage disposal, beverage holder, tables, among others. The space could also be better used if, on the side with less chairs, a chair was added between each pair, thus creating a continuous wave of seats.

Image 96. 1st class carriage concept study 1, 2014, Author: Sofia Malato

Image. 97. 1st class carriage concept study 2, 2014, Author: Sofia Malato

Image 98. Top view, chairs distribution 2014, Author: Sofia Malato

OTHER PROJECTS

7. Tram proposal for a contest

This project involves the creation of a new line in a city in France. This project started as a contest where, each company had to make a project proposal so that the client could pick the one they think to be more suitable for the project. MBD Design wasn't the chosen one.

In this initial phase there are not yet many exigencies in terms of features, and objectives, since it is simply a conceptual exercise and MBD Design wasn't willing to invest much time in a project that is not sure they will have.

For the development of this project it was necessary to make a recognition of the locations through which the new lines will pass and a campus analysis to observe the people and the surrounding environment.

The new line environment is composed by a mass of social housing made in the 50s/60s, some architectural wanderings from the 70s/80s and exuberant architecture from the 90s. It's an urban environment with some farms and village churches. There are some notably affluent places, however, there is a predominance of a suburban environment with graffiti-expressions are generally symptomatic of poor neighbourhoods, and representative of communities who feel rejected.

The tram aims to help people in make their daily lives a little more convenient or even enjoyable.

The creative research was performed by the 3 interns. All concepts proposed where discussed with the other employees and with the project manager, some concepts were approved, some others improved and some originated from the discussion.

Theme

The themes/concepts bellow were proposed by MBD Design in order to answer to the clients briefing. The design concepts proposed to the clients where:

1. "Line" a living entity: Links places and people. The tram is neutral, without religion, without political opinion, it is useful to all. As such, it is able, alone, to build a new entity "The Line." "The Line" becomes the new builder of the environment (MBD Design, 2014);

2. The bond: Provides the link between men and women from all backgrounds, landscape and architecture. The tram should show this link between different nationalities and skin colours so that everyone can somehow recognize a geometric "surface" that represents them;

3. A festive print: A joyful tram, to interlude in a gray and gloomy day. The tram should use fun and festive symbols to generate smiles and excitement. Its serious and reliable character can afford to be outspoken without compromising the public transport image quality;

4. People: The better way to attract travellers to the new tram line is to show them, in the most explicit way, that this service is for them. It should represent them in all their richness and diversity, show their differences. The approach should be accompanied by the use of joyful graphic codes;

5. Safe comfort: The tram is a protective metal device that will allow to relax comfortably, in an environment that can be perceived by some to be hostile and endure anxiety. By offering a strong perception of a sustainable public service that is concerned about the safety of its users, and by making them feel welcome, it is possible to counter this perception;

6. Outside / inside: Establish a better communication between the exterior and interior of the tram by considering them as independent entities, defining a graphic visual link, through the doors and encouraging the exchange.

Target

All type of users, from children to adults and elders including handicapped people. Its shape and aesthetics must suit the majority.

Objectives

The new tram should cover the following objectives:

1. Coherence: with the identity of the client company, this identity already exists and is developed;

2. Integration: It has to be integrated in the human capital;

3. Aesthetics: Pleasant, that integrates by contrast;

4. Comprehension: Facilitates the comprehension of the organizing authority role;

5. Self identity: That identifies with the style of the client brand / company.

Features

The tram must have:

1. Colours: Metallic gray, plus 2 complementary colours, white and black and possibly other colours that come together well with the previous 3;

2. Symbols and logos: From the collaborating companies, readability by users is imperative;

From the 6 concepts/themes listed above, 2 final designs were developed exclusively by the author of this report: The concept about the festive print (3) and the concept about people (4).

Creative research

Study 1: Illusion of wavy mirrors. The graphics represent colourful balloons.

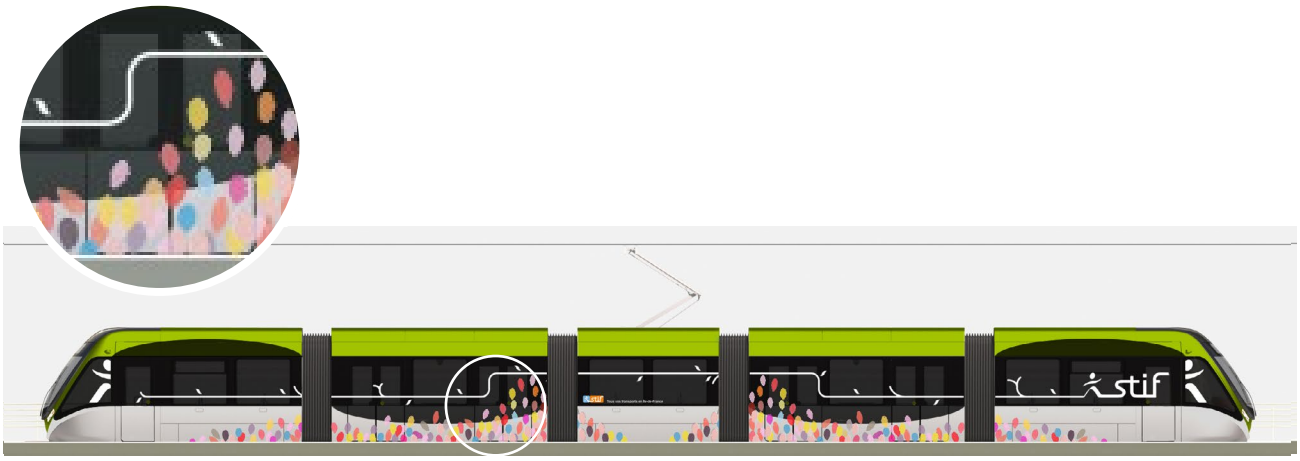


Image 99. Graphics study 1
2014, Author: Sofia Malato

Study 2: Impressionist graphics.

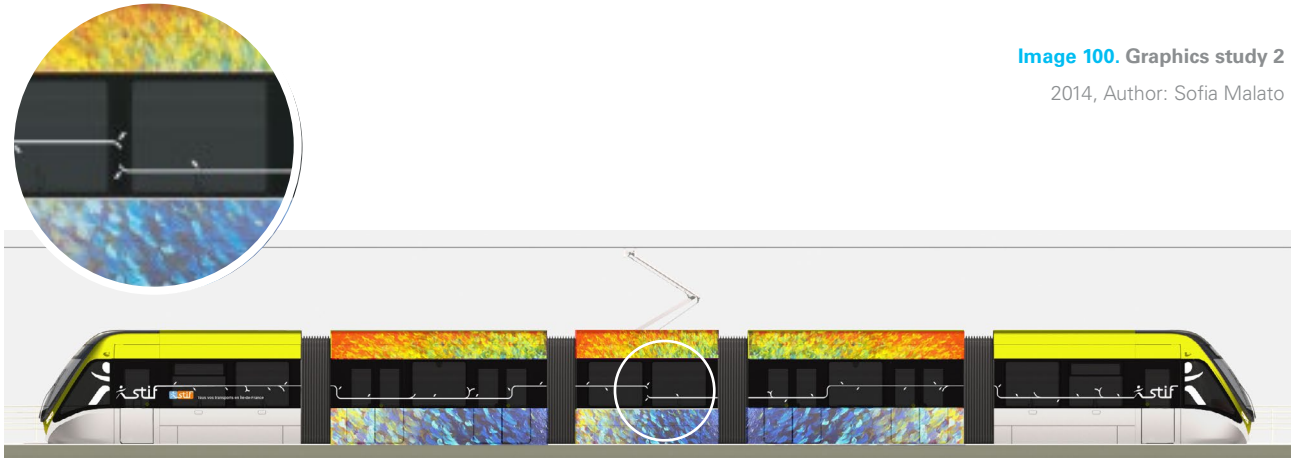


Image 100. Graphics study 2
2014, Author: Sofia Malato

Concept 3: Illusion of wavy mirrors. The graphics represent colourful leaves forming flowers.

Image 101. Graphics concept 3 2014, Author: Sofia Malato

Concept 4: The graphics represent people-the most important aspect in all design projects. It represents men and women in their richness and diversity.

Image 102. Graphics concept 4 2014, Author: Sofia Malato

Other companies/agencies were competing for this project. The concept designs, were sent to the client but the client chose another agency for the project continuation.

8. Metro Layouts

A. Metro 1

The metro was developed by the senior designers, interns only helped in the final stage, the detail phase, by helping designing different layouts. This metro is for 2 lines in China, 1 metro line is magenta on the map and the other brown, the client asked to experiment with this 2 colours and to mix them with a 2nd colour. The layouts were performed in Photoshop. The final layouts were perfected by the senior designers.

Studies metro 1

Layout 1.1

Transmits dynamism, speed and strength.

Image 103. **Layout 1.1.1**
2014, Author: Sofia Malato and MBD Design

Image 104. **Layout 1.1.2**
2014, Author: Sofia Malato and MBD Design

Image 105. **Layout 1.1.3**
2014, Author: Sofia Malato and MBD Design

Layout 1.2

It is inspired by nature, a very common theme in the Chinese culture, with its organic and natural shape. The interruptions in line (image 4 and 6) represent the stops in the various stations.

Image 106. Layout 1.2.1
2014, Author: Sofia Malato and MBD Design

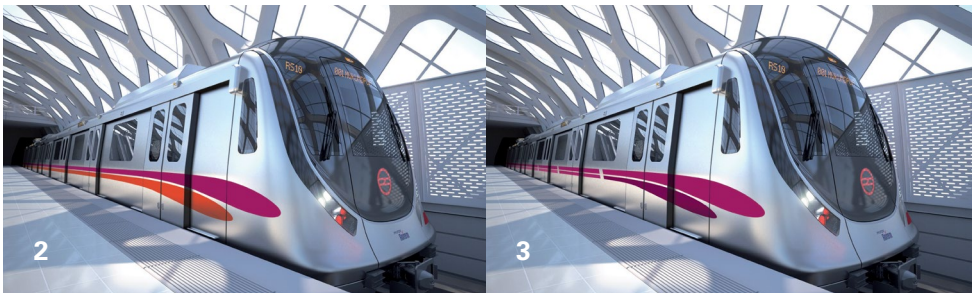


Image 107. Layout 1.2.2
2014, Author: Sofia Malato and MBD Design

Image 108. Layout 1.2.3
2014, Author: Sofia Malato and MBD Design

Image 109. Layout 1.2.4
2014, Author: Sofia Malato and MBD Design

Image110. Layout 1.2.5
2014, Author: Sofia Malato and MBD Design

Image 111. Layout 1.2.6
2014, Author: Sofia Malato and MBD Design

Image 112. Layout 1.2.7
2014, Author: Sofia Malato and MBD Design

Layout 1.3

It is inspired by nature, this design is simple and gentle, gives an idea of a pleasant and tranquil journey instead of a dynamic and fast one (layout 1.1).

Image 113. **Layout 1.3.1**
2014, Author: Sofia Malato and MBD Design

Image 114. **Layout 1.3.2**
2014, Author: Sofia Malato and MBD Design

Image 115. **Layout 1.3.3**
2014, Author: Sofia Malato and MBD Design

Image 116. **Layout 1.3.4**
2014, Author: Sofia Malato and MBD Design

B. Metro 2

Like the previous project, the metro was developed by the senior designers, interns only helped in the final stage, the detail phase, by helping designing different layouts. In this case the client asked to make designs in different types of existing headlights as well. The final layouts were perfected by the senior designers.

Studies metro 2

Headlights 1

It is important to establish interaction between headlights and the layout. In this images the red band starts always on the headlight. The 1st design provides a balanced relation between headlight and red band, this is because the red band follows the metro structural lines.

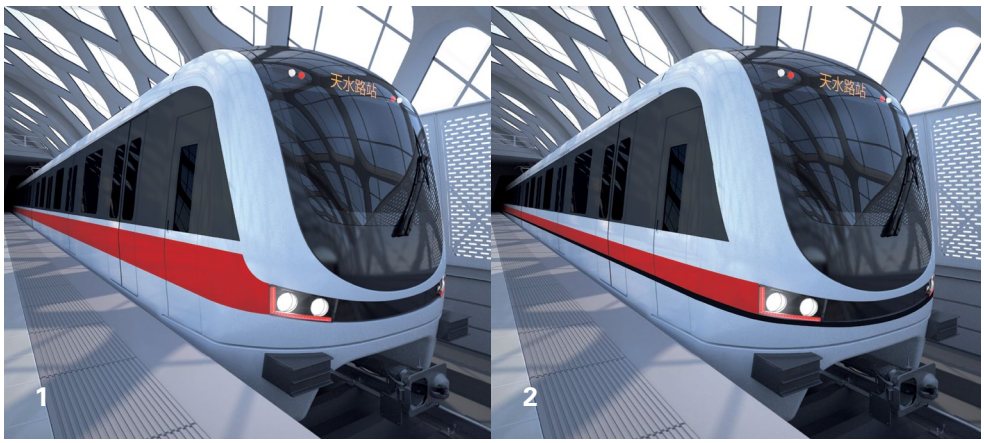


Image 117. Headlights 1.1
2014, Author: Sofia Malato and MBD Design

Image 118. Headlights 1.2
2014, Author: Sofia Malato and MBD Design

Headlights 2

This layout would results better without the black surface that is there to give an idea of a continuous window. The red band as the previous version follows the headlight, the band is simple and geometric. Angular lines give an idea of speed and dynamism, the bigger is the contrast the more dynamic it looks (unless the angle is to high).

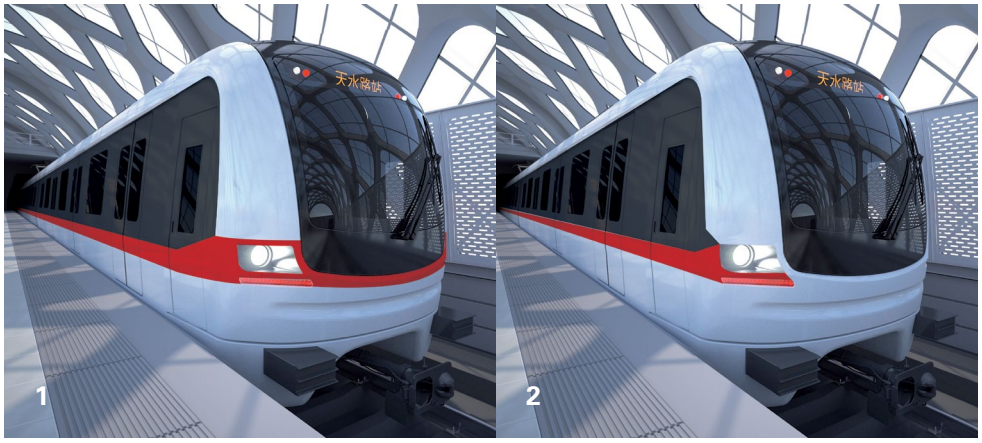


Image 119. Headlights 2.1
2014, Author: Sofia Malato and MBD Design

Image 120. Headlights 2.2
2014, Author: Sofia Malato and MBD Design

Headlights 3

The 1st and last layouts have a more organic style, the 2nd one is more geometric. All 3 designs, like the previous designs, originate from the headlights. The last design has a better appearance with just the red band.

Image 121. Headlights 3.1
2014, Author: Sofia Malato and MBD Design

Image 122. Headlights 3.2
2014, Author: Sofia Malato and MBD Design

Image 123. Headlights 3.3
2014, Author: Sofia Malato and MBD Design

Headlights 4

The red band follows the lines of the headlight, forming an wavy shape at the front and finishing by a straight line.

Image 124. Headlights 4.1
2014, Author: Sofia Malato and MBD Design

C. Metro 3

By using a metro model already developed, the interns had to quickly develop new fronts for that model of metro. For quickness and efficiency, one of the methods adopted was sketching over small copies of the front view and once there was a good amount of samples, all the designs were posted on a board and compared. Once the senior designer responsible gave us his point of view, the next step was to draw in Photoshop with the suggestions given or perfect the model in case it was already drawn.

The internship ended before this project was finished. The initial sketches can be seen in the appendix chapter.

Photoshop drawings

1. The design lines are dynamic, a mix between geometric shapes, like the triangular headlights, and organic shapes, the red and white headlights look like a flower upside down. The triangles have no vertices but curves. The overall shape is appealing, dynamic and modern. The metro "face" is neutral.

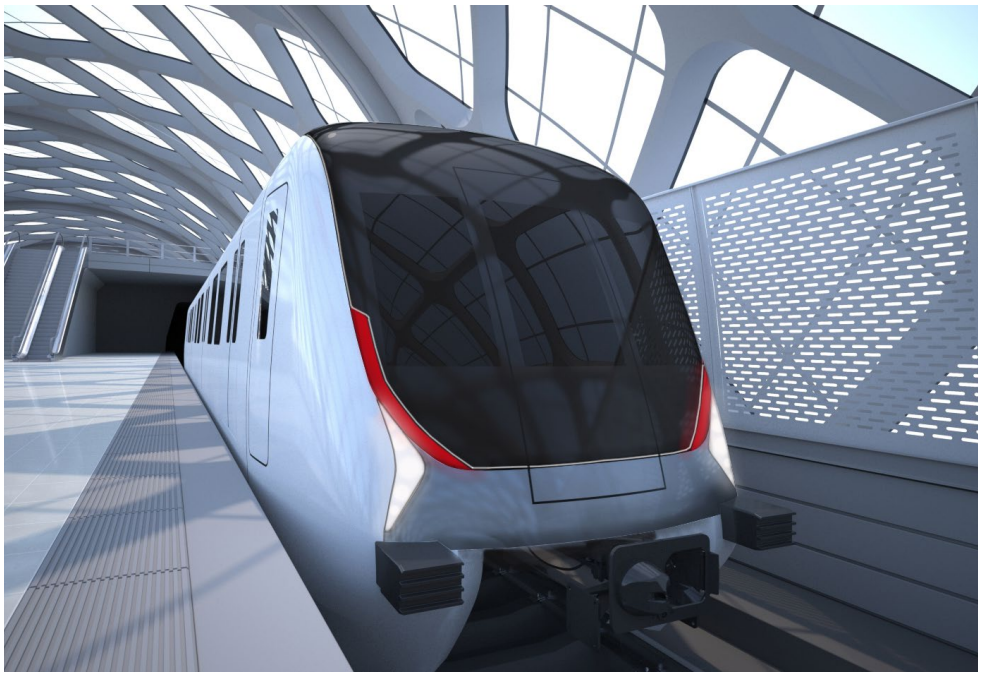


Image 125. Metro 3, design 1
2014, Author: Sofia Malato and MBD Design

2. The design lines are a minimalist set of soft curved lines. The headlights form an arc, the front glass follows the headlights and has a rounded shape. The design is modern, delicate and appealing. The metro "face" is serious.

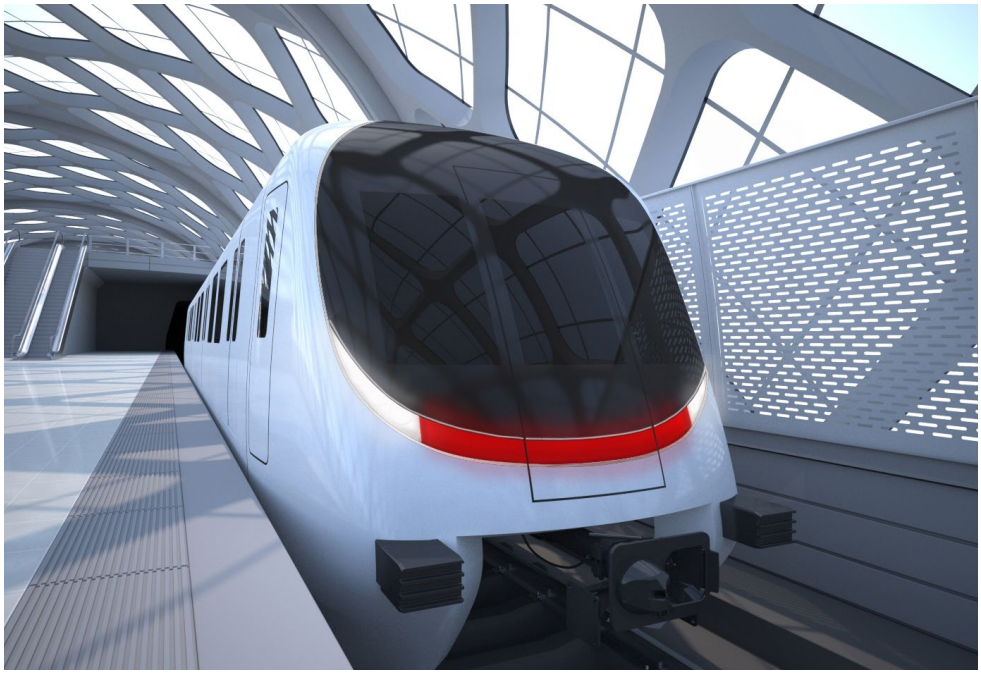


Image 126. Metro 3, design 2
2014, Author: Sofia Malato and MBD Design

3. The design lines are mainly curved. The metro has a door in the middle, this design shapes the front making the door discrete but at the same time salient, this because in opposition to the previous designs, this door has no visual interruptions (the headlights for example). Once again the design has a serious "face", The headlights look like eyes. It seems that the metro is using a helmet, the front has a futuristic look and seems robot like.

Image 127. Metro 3, design 3
2014, Author: Sofia Malato and MBD Design

9. *3D modelling*

Interns were required to help the senior designers during projects, performing tasks such as 3D modelling and research of online models. The following images will show samples of developed models.

A. *Manometers*

Image 128. Manometer for liquid air bottle add-on tops , 2014, Author: Sofia Malato

Image 129. Digital manometers for liquid air bottle add-on tops , 2014, Author: Sofia Malato

Image.130. Radio

2014, Author: Sofia Malato

Image 131. Radio telephone

2014, Author: Sofia Malato

6. Results

RESULTS ASSESSMENT

Through the projects performed during the internship, it can be observed that the participation of the intern happened especially in the creative research phase, which includes: visits to places to take pictures and observe the subject in its environment (field analysis), market research and inspirations research and finally concept development by using manual and digital sketching and 3D modelling.

Every project followed usually the same methodological steps, only sometimes it was necessary to do a field analysis and other times not. When a new project was introduced by the creative director, the first step was always to read the briefing (when available at the time). Sometimes the client was telling the themes desired for the project and from that, the interns created concepts that suited their choices, other times, the themes were free, so the interns had to decide together which thematics of research were more suitable for the project. Most of times mooadboards were about: technological interfaces; censorial experiences (both tactile and visual); interactivity; theatralization; accessibility; adaptability; geometry; nature; modularity and minimalism. The moodboards were posted on the walls and after were discussed with all the design professionals involved in the project. After selecting the topics, each team element worked on their own concept ideas, this ideas were constantly compared and discussed in group in order to decide which concepts to follow and what to improve. Even though one main project was always chosen, MBD Design, selects at least one idea per project member to send to the client. The client will after send a feedback, most of times proposing changes, once the final concept is decided the interns move to other projects, assisting senior designers in development only when needed.

The development phase, was followed and monitored by the senior designers, which made it difficult to follow a project from beginning to end, also, because at the end of the internship most projects were still on going. Another reason for not participating in the development phase was the lack of experience, even on the creative research phase the inexperience brought less productivity, particularly in the 3D modelling and Photoshop rendering. The project execution time was also a limitation, since a lot of projects were happening at the same time, therefore there was less time to notice details. It was not always possible to develop larger projects, some of the works requested were limited to fast

proposals to submit to tender and many of them did not continue.

Each proposed project required elements of individual and group work, since each element was working in different concepts. Even though most colleagues spoke English (varying from basic to advanced levels) the group communication often became difficult due to language limitations. French was improved during the internship; comprehension become better, however the vocabulary is still limited. The strain on communication sometimes led to the miscommunication of ideas, yet this did not greatly affect the results, more so just lost time in adjustments.

Customer participation was constant in most cases, MBD Design and the client met several times both at the agency office or at the clients office (abroad or not). Interns and customers did not communicate directly so all information about the necessary changes was passed on to the interns by the creative director.

The time to perform each task depended on the project urgency and amount of projects that were happening at the same time. Sometimes it was given only one week to perform creative research and concept development (including 3D modelling), other times 4 weeks for the same tasks, the average time was 1 to 2 weeks to market and inspiration research and 2 to 3 weeks for concept development.

Throughout this apprenticeship some difficulties also emerged, like it was referred above, the language was the biggest challenge, communication is essential in order to work well with others, this limitation was improved with time(due to studies and time spent in the country). Another challenge was to learn to do faster and learn to ignore details, the lack of time and exigence given, led to a bigger difficulty processing research data into solid concepts.

The data obtained from this internship respond to the investigative topic, yet, the amount of rail transport vehicles projects to which the author of this report had the opportunity to participate, were less than the expected. At the end of the internship, a project of interiors for a train to Austria arose, but with the arrival of the internship end it was not possible to develop a thoroughly creative research.

Working in a studio is different then expected, and has nothing to do with doing a school project. For example, in the state of art, an exhaustive study about ecological footprint was made, which is very important in the design process, however, during the internship, the little time available for each project didn't allow to pay much attention to this topic. Also, there are plenty of design methods that help organizing ideas eliciting more creativity, this methods are used by a lot of recognized companies worldwide such as IDEO. MBD Design uses the most common and basic methods that are used by most or even all design agencies, that is, the use of market research, field analysis and moodboards. It was expected by the author of this report to be able to learn

new innovative design methods, just like the ones that were refereed on the state of art. However, MBD Design is a solid and successful agency that has no need to innovate in terms of methods, its current design approach has proven to please many customers over the years.

MBD Design has a calm working environment, in some occasions workers are more stressed out but when so, more freelancers are hired to help. Most employees know each other for several years, or even decades so they trust and joke with each other frequently. Working in a environment like this is generally pleasant, however, when something is not good it is outlined, but when something is good and ready to send to the client, positive feedback is rarely done. Positive critics and feedback are important to motivate the employees and to improve professionally. This is one of the main differences between the academic and professional environment.

The best part of working in a studio, first is to be able to learn and participate in projects that will be applied in future, second is to have a stable 9am to 6pm working schedule, to be able to enjoy free time at the end of the day and during the weekend. French workers have a more relaxing schedule than in most Portuguese companies and they legally work less hours per week, it is common for everyone to start their weekend earlier by living the job on Fridays at 5pm.

One of the best advantages of being abroad in an Erasmus context is to be able to meet and interact with a variety of people, from different cultures and different personalities: a person who travels frequently and/or has lived in other countries is generally a more open minded person, should always be ready for new challenges and in many cases also more ambitious.

The internship, did not completely correspond to initial expectations. Some of the general and specific objectives defined in this report, have been met while others have not.

The following objectives, are considered to be achieved:

1. Comprehension of how a design studio and its team work;

2. A better understanding of the aspects that engage the transports and product design;

3. Acquisition of new skills such as, creation of new creative processes and production processes: This new skills are very different from the ones learned in university, specially regarding the time and level of detail;

4. Improvement of a critical and analytical thinking;

5. Cultural development;

6. Implementation of skills gained during the studies, in the labour world;

7. Development and acquisition of new skills, in terms of software, management and work quality;

8. Improvement of teamwork capabilities and overcoming challenges;

9. Comprehension of the desired career direction: Although there is a preference, by the author of this report, for the area of rail transport vehicles. It was realised that it is preferable to work in a global design studio (more advanced than MBD Design, that focuses mainly on Rail transport vehicles and products for the industry), that develops home products as well as personal items.

10. Dealing and learning from experienced designers;

11. Learning a new language in order to use it in everyday life;

Below are the objections that were not considered achieved:

1. Acquisition of new methodologies and processes that will be put to the test for product development;

2. Improvement of capacity of speech: The use of a foreign language did not help.

3. Follow the development of a real product: The projects were partially followed, this because the internship period was to short to be able to follow a project from beginning to end, also, interns usually work mainly during the initial phase (creative research) than in the whole design process of the project.

It can thus be concluded that, most of the objectives were achieved, yet, the experience could be more rewarding if the internship had a longer duration. The initial stages are more for adapting to the new environment, but when greater independence and fluidity of work was felt, the internship was already about to end. There were also times when work was scarce and less diversified.

The final results didn't stir up the feelings of self-realization expected, due to the intern really high expectations, but the important is that it was possible to answer to the research question, that is, to understand how a international studio works and to be able to learn and grow professionally and personally.

7. Conclusion

The main goal of this internship was to experience a real working context, to understand how a design studio works, the methods and processes that are used and how is the approach to the Design of Transports, Products and Spaces.

This experience was important to help the student cross the bridge between learning and doing, that is, use what it was learned in university and applying it in everyday situations in a design Studio. To respond to everyday problems, product design uses several processes and methods of design thinking to help understanding the environment and the needs and allow better results. Product design is a very broad area, always present in everyday life, making good products, making it not only a pleasure but a necessity. The design makes the user life simpler, more comfortable, faster, more efficient, more beautiful and more meaningful. The user is thus the most important element of the design process because it is where the products are centred. It is thus the product designer who is responsible for designing functional, innovative, aesthetically pleasant and ergonomically correct products that meet users' needs and the requirements of the customer and the market.

Whit this internship it was possible to participate in interesting projects related to the topic of research, projects for reputable companies that few inexperience designers had the chance to work with, alongside experienced Senior designers. Interns had to work manly on creative research, that is, creation of moodboards and development of concepts for several projects, occasionally, for more than one project at the same time and provide assistance to senior designers, with 3D software and image editing.

This experience permitted to learn about how to ensure a smooth internal functioning and good results in a design agency, for that it is necessary to: maintain a dialogue and exchange ideas with colleagues; maintain a friendly and relaxing environment; be independent; ask questions whenever there is a doubt; have a spirit of helpfulness; maintain consistency between works carried out by different team members; respect the line and the design style of the company; be aware of new design innovations; have a good relationship and respect by the client demand.

Doing an internship abroad also brings many benefits, a study in a different cultural context, implies increased effort specially regarding the differences in language, culture and habits, that also makes whole experience more interesting

and challenging. On a professional level, an internship abroad can enhance the curriculum, because it requires an additional set of skills that go beyond the capacities of simply performing a job. This includes capabilities like independence, courage and ambition.

So how does a Design company/agency/studio becomes successful? How to become a good professional? MBD Design has proven to perform worldwide successful projects that were possible because the agency had a solid career, which followed the technological and aesthetic development over the years. Also, has prime location, in central Europe, near a developed and reliable market. MBD Design chooses the best employees and promotes design education; by receiving interns constantly MBD Design can help preparing the future designers in becoming better professionals. Other key points for success is method, trust and respect, a good product needs to follow a logic and coherent process, and MBD Design has kept the same working process over the years. The employees trust each other because they know each other, they communicate and they respect each other, authority and client demands.

Working in MBD Design is very rewarding, not only for "what" was learned but for "how" it was learned. Making mistakes is part of the learning process and it is by making mistakes that it is possible to realize what is needed to be improved - Paul Arden says that "The person who doesn't make mistakes is unlikely to make anything" (p.50). Going abroad to a successful design agency, many times brings high expectations like "we will change the world" and create amazing products, but, it is all a growing process, from the bottom to the top, and to grow it is necessary to start with less exciting things.

The most important, is to be able to apply in the labour market, the knowledge learned so far, deal with new people and cultures and be humble and understand that there is still much to learn and above all, understand that is the critic that makes people grow.

8. Recommendations

In general, the results were positive, good methodological processes, facilitate creative thinking, providing greater opportunities for innovation.

Given the results obtained through the analysis of the study cases, it is recommended for future research to include other studies that apply other methodological processes.

Within the area of transportation and product design, studies on the interaction between different types of passengers, different types of travel and the need to make public transport more appealing in relation to particular, are recommended. It is also recommended an exhaustive study of benchmarking of products and technological innovations and also a study of the user / target, which is and should be the main focus of the design and should therefore, be the main object of study.

Given the context of conducting active research, it is also recommended similar studies involving several countries so that results can be compared in order to understand the cultural differences that can lead to a global concept of product design.

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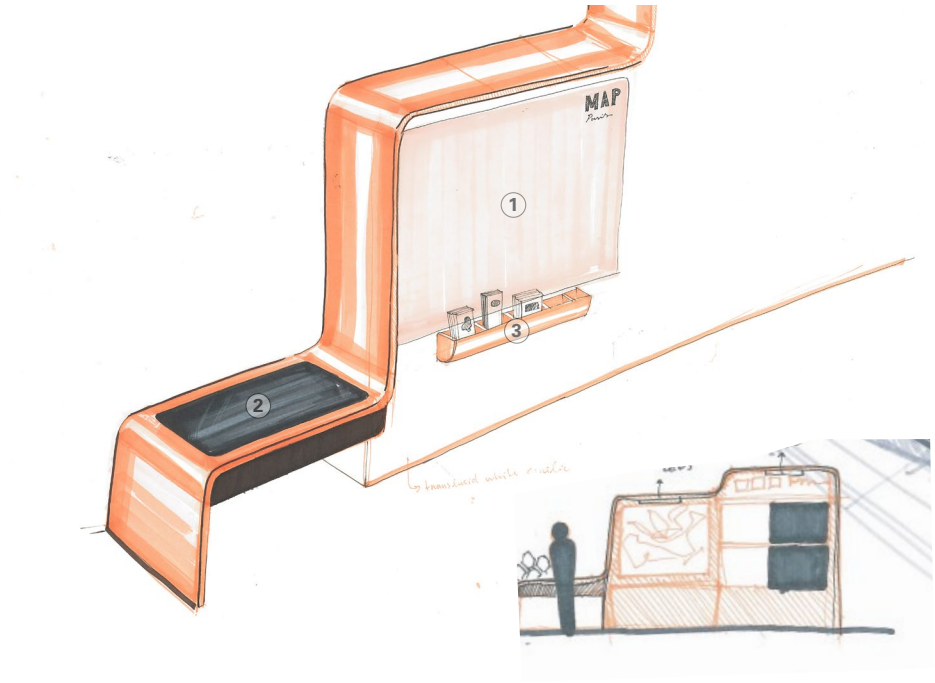
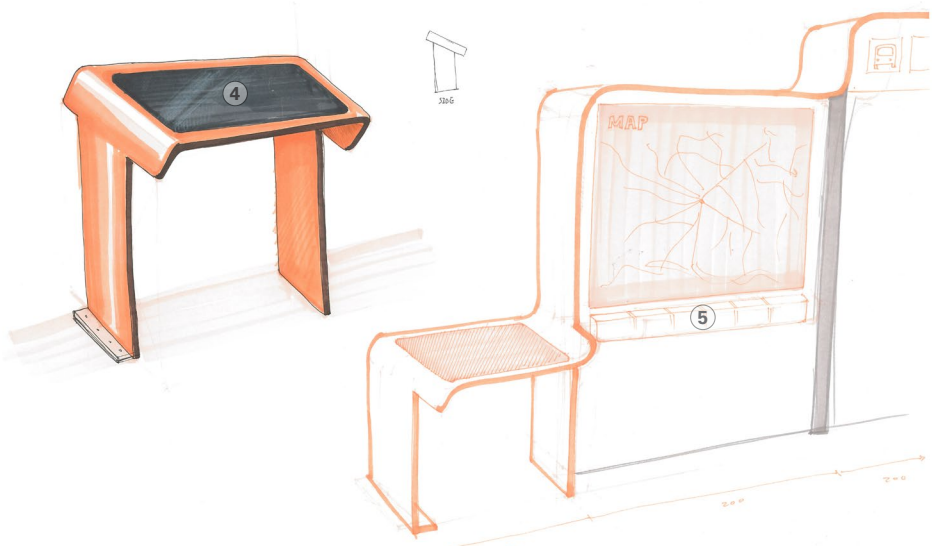
10. Appendix

MAIN PROJECTS

1. *Airport*

Creative research / Sketching of ideas before to arrive to final concept.

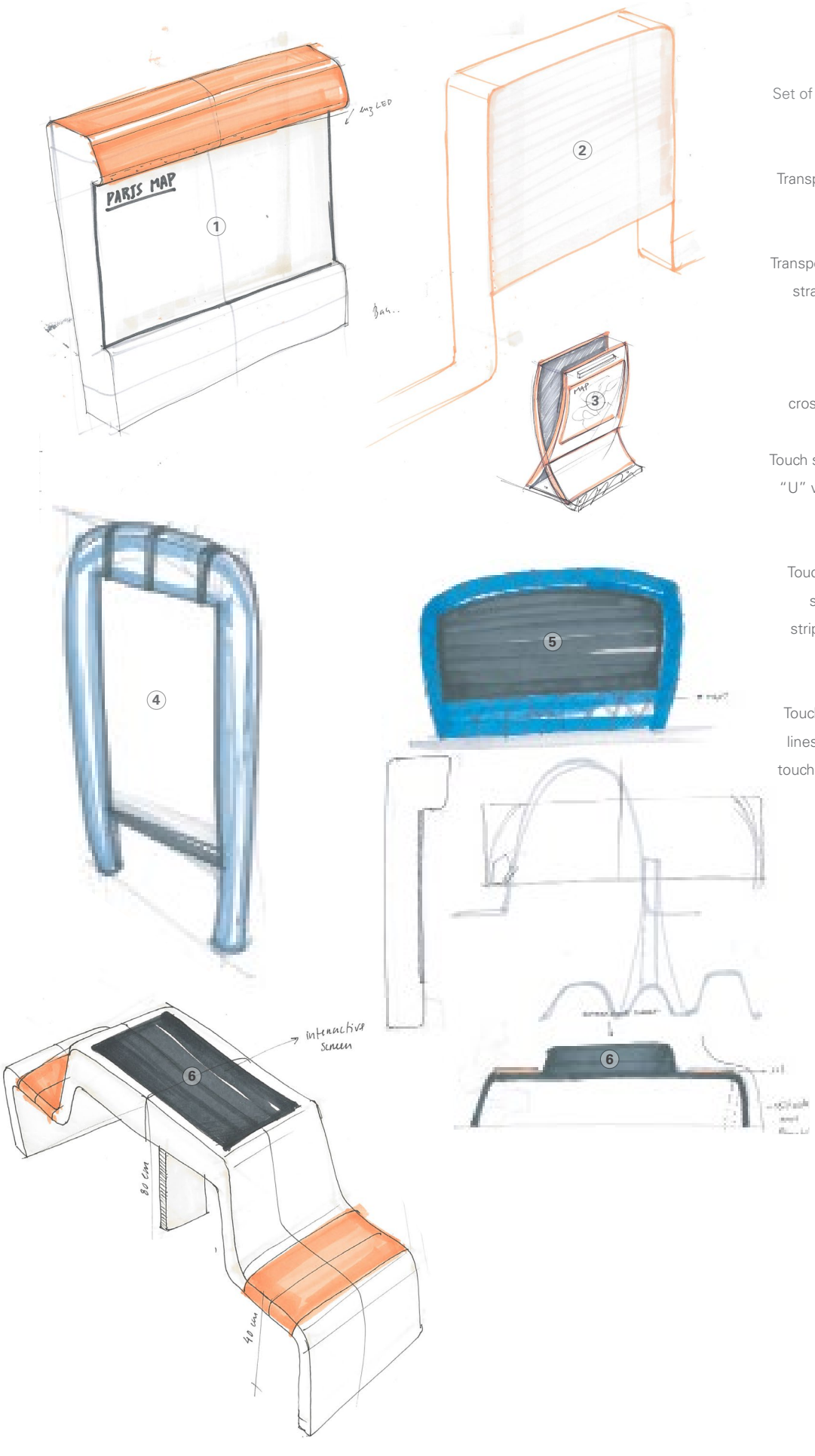




Legend 1

This set of drawing represent a part of what goes inside the information point. Straight lines with small curves grow in height (forming more than 1 "L"), the design is minimal:

Transport map (1)
Touch screen 1 (2)
Pamphlets support 1 (3)
Touch screen 2 (4)
Pamphlets support 2 (5)



Legend 1.2

Set of touch screens and map supports:

Transport map 1: Classic, top shaped in "L" (1)

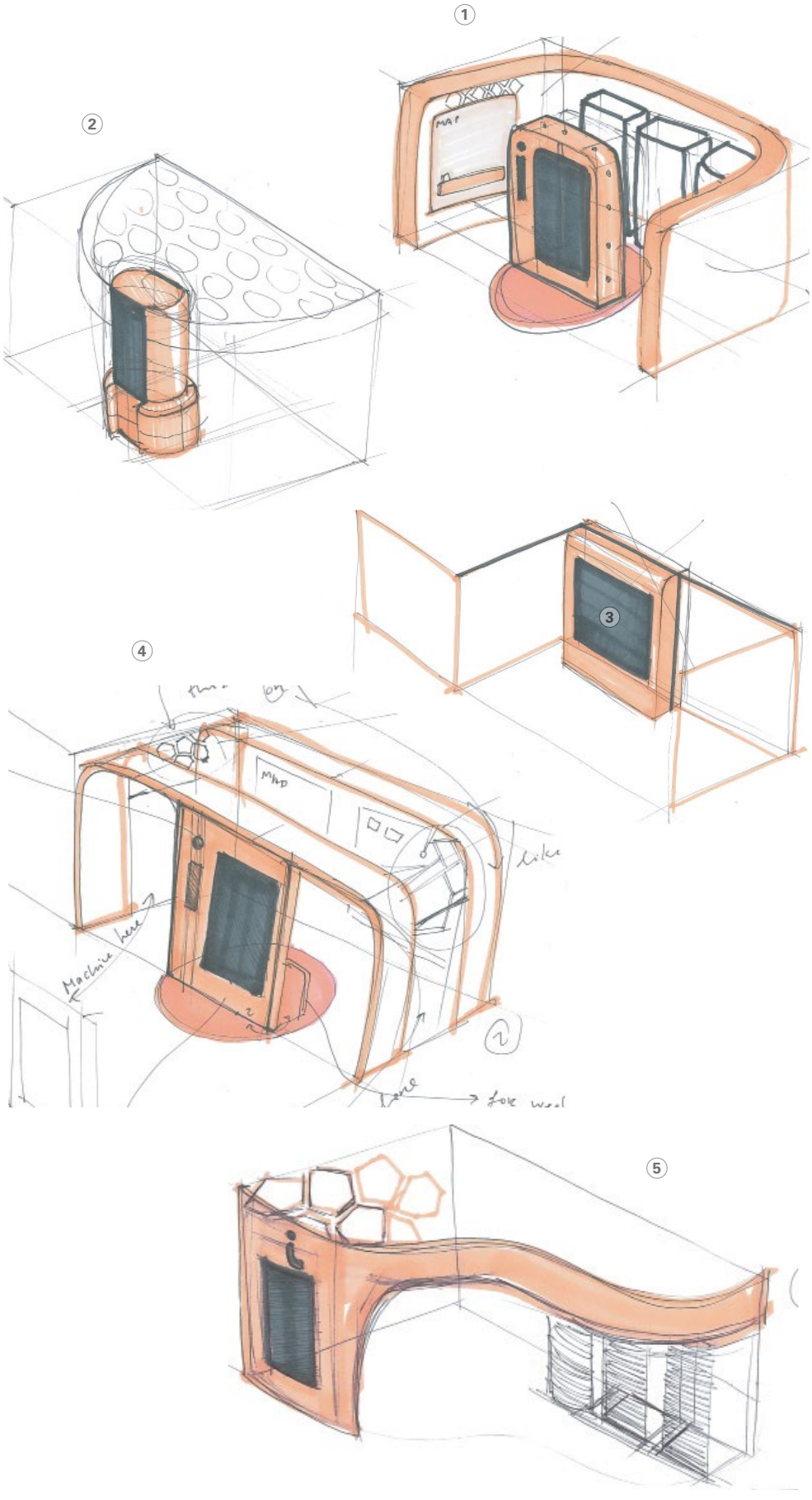
Transport map 2: Minimal, strait lines with curved corners. (2)

Transport map 3: 2 crossed curved boards. (3)

Touch screen 1: Shaped in "U" with 3 metal stripes at the top. (4)

Touch screen 2: Curved shape, with crossed stripes symbolizing the metro map. (5)

Touch screen 3: Straight lines forming an "L", this touch screen has 2 seats incorporated. (6)



Legend 1.3

Set of information points, studies of information panels and overall shape:

Information point 1: (1) Shaped in "U" both panel and overall shape, the parallelepipeds at the rear are the ticket machines, the maps are one on the left one on the right, the information panel is in the middle.

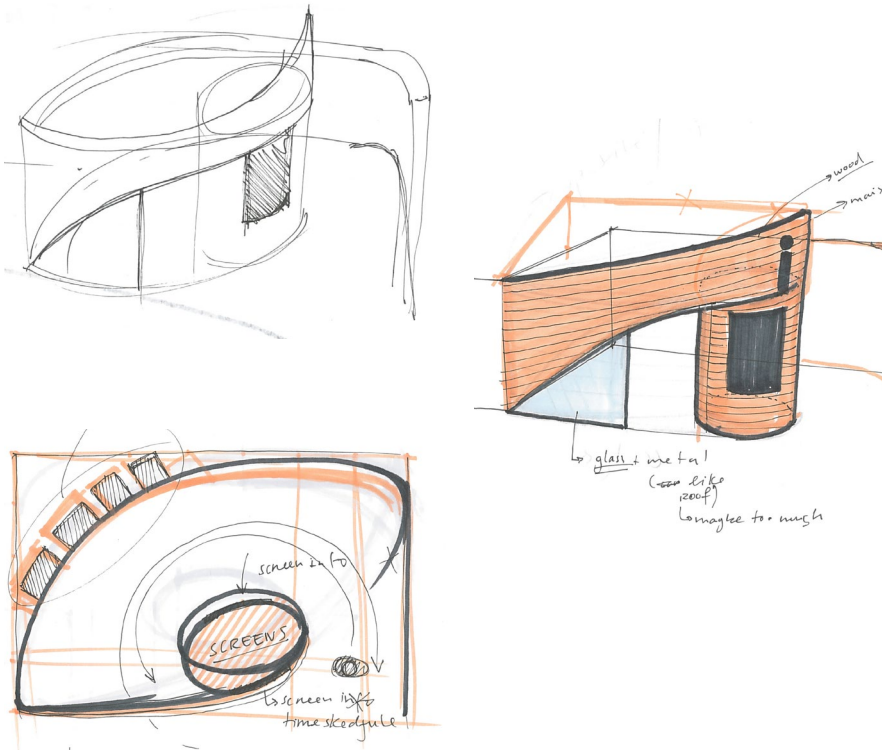
Information point 2: the (2) roof is a demi circle with holes on the top, the information panel is oval, screens are strait and located in both sides.

Information panel: (3) rectangular shape, curved on the top.

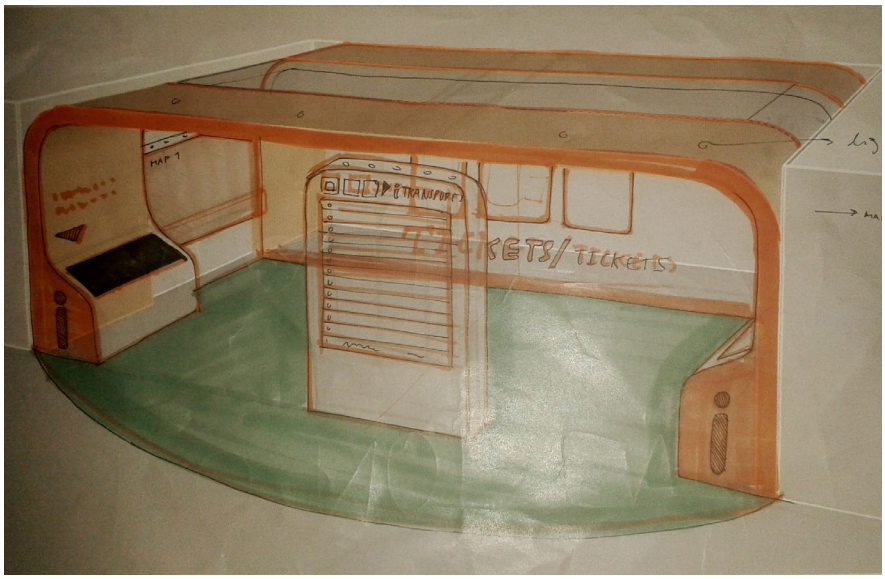
Information point 3: (4) walls Shaped in 2 large "U" shapes with a 3rd "U" cut with a pattern, metro map on the right and hexagons on the left, the informational panel is rectangular in order to contrasts with the rest.

Information point 4: wavy (5) shape, the roof is cut by several hexagons, information panel is located outside, ticket machines and the rest inside.

6



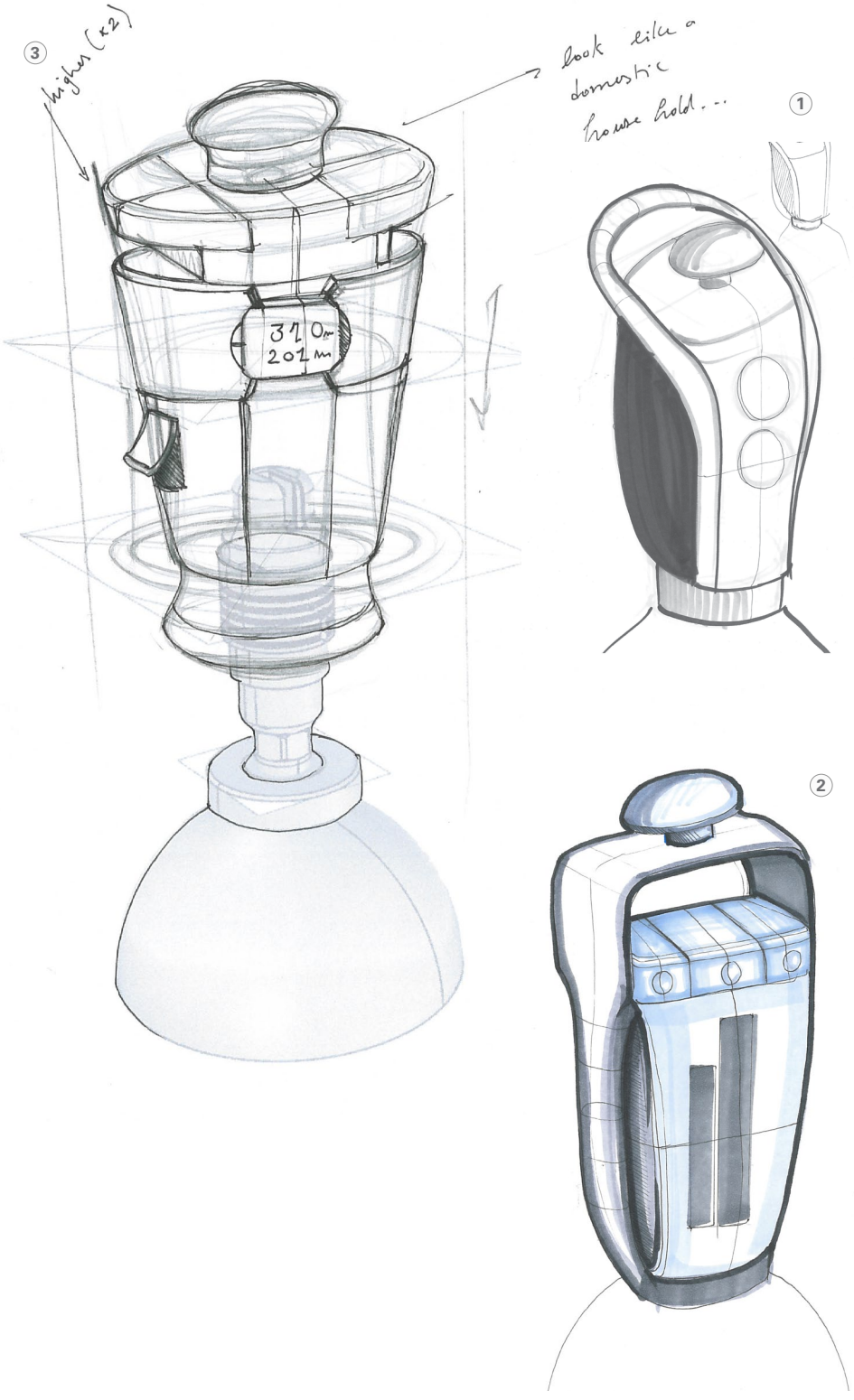
Information point 5: 6
Spiral overall shape, the information panel is in the end of the spiral, the interior walls are curved, the exterior walls are strait at the rear, curved in the entrance.



Legend 1.4
Final sketch before to modulate in 3D.

***2.** Liquid Air Bottle*

Creative research / Sketching of ideas before to arrive to final concept.



Legend 2

Sample of add on tops sketches:

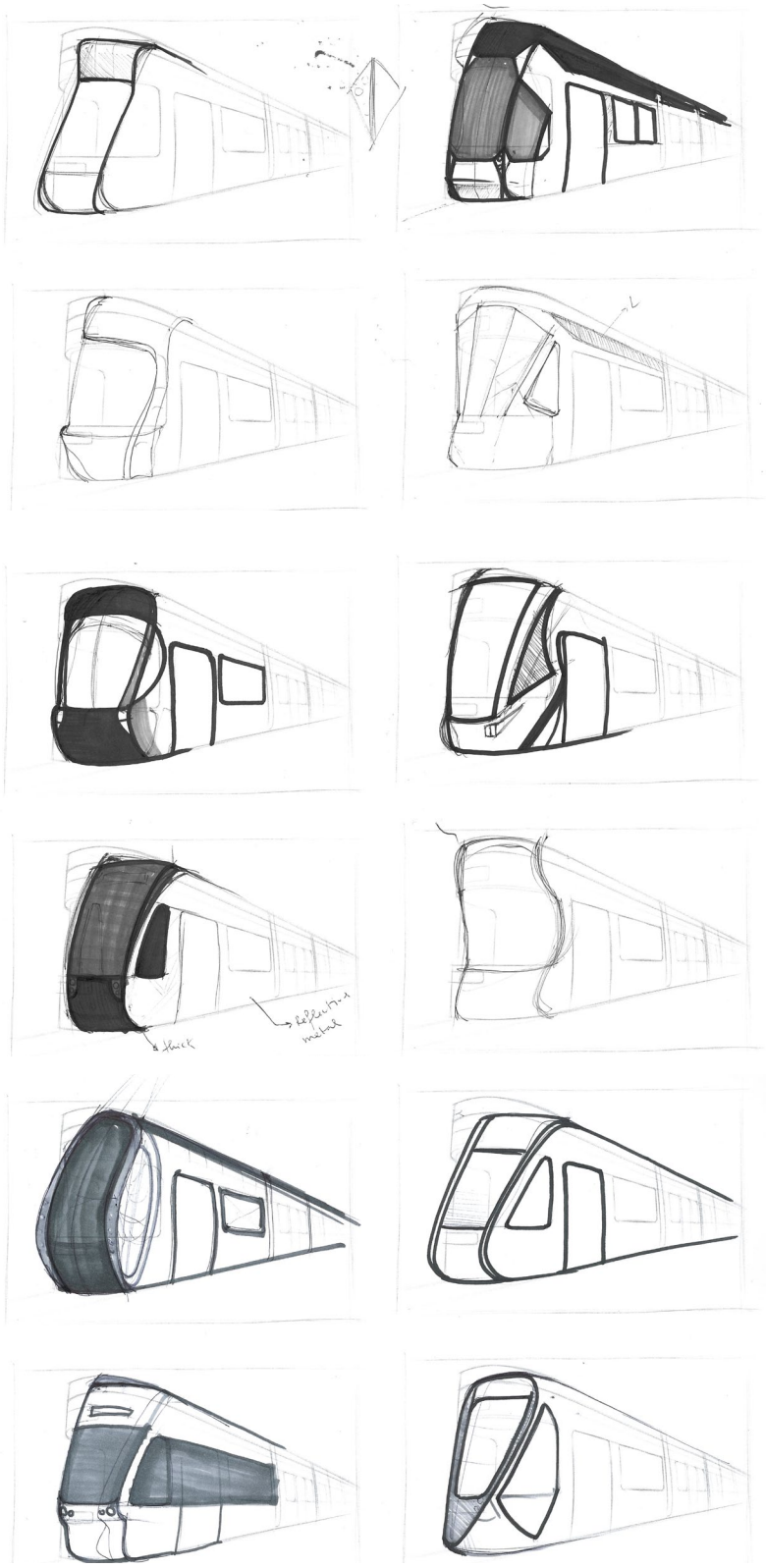
Add on top 1: the (1) "mushroom" top is used to help transporting the device (to role). The handle works as an extra help to hold and move the bottle. The rounded circles represent the 2 nanometers.

Add on top 2: the (2) "mushroom" top has the same function as the previous one, the 3 parallelepipeds below that are separated , one contains the geolocator, the other the wireless and the other the battery. The vertical rectangles on the add on body represent the digital manometer.

Add on top 3: Final sketch (3) before to modulate in 3D.

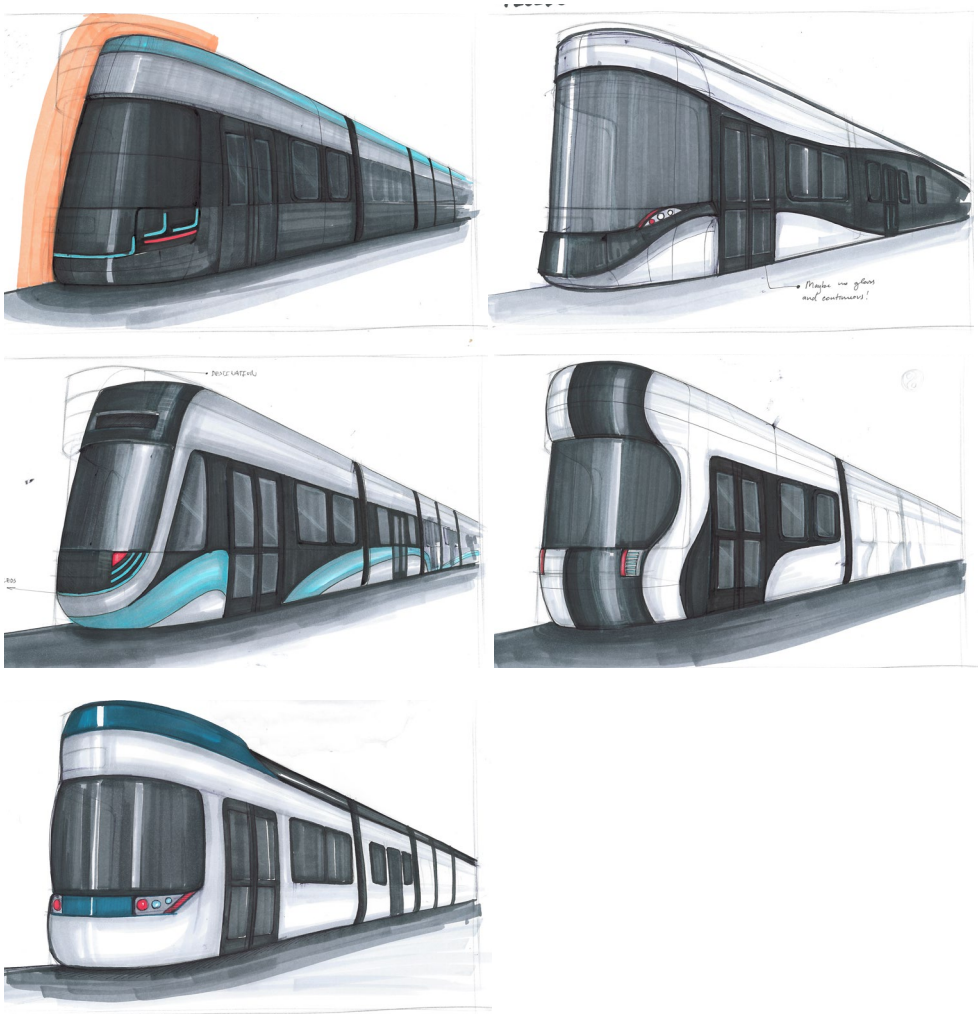
3. *Tram exterior for China*

Creative research / Sketching of ideas



Legend 3

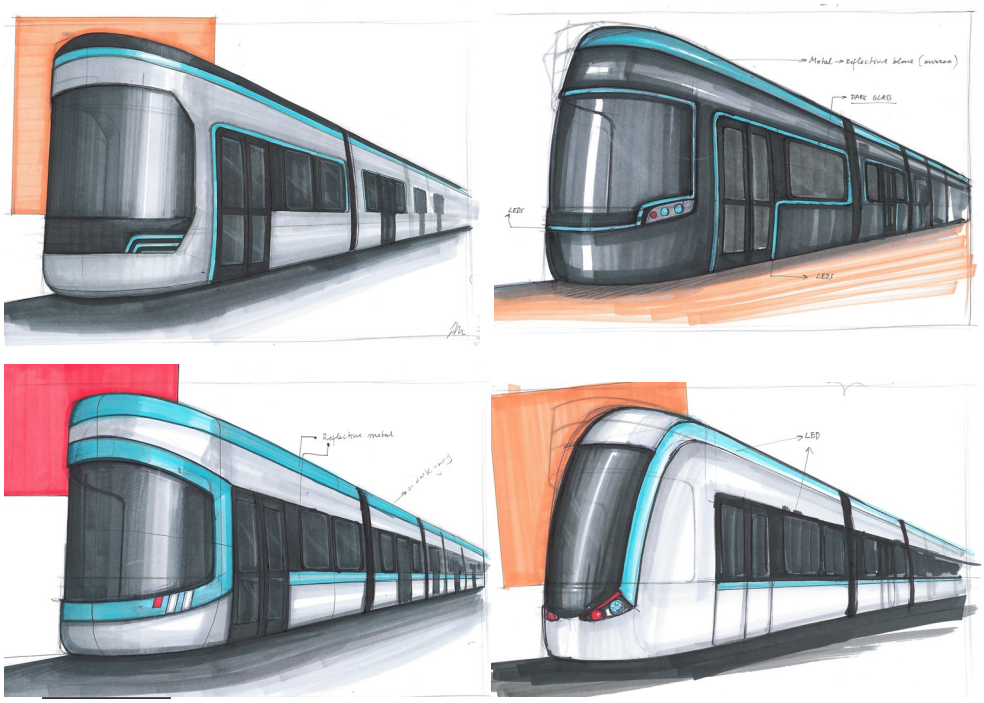
Set of trams studies: Some designs are inspired in the modern theme and others in the nature.



Legend 3.1

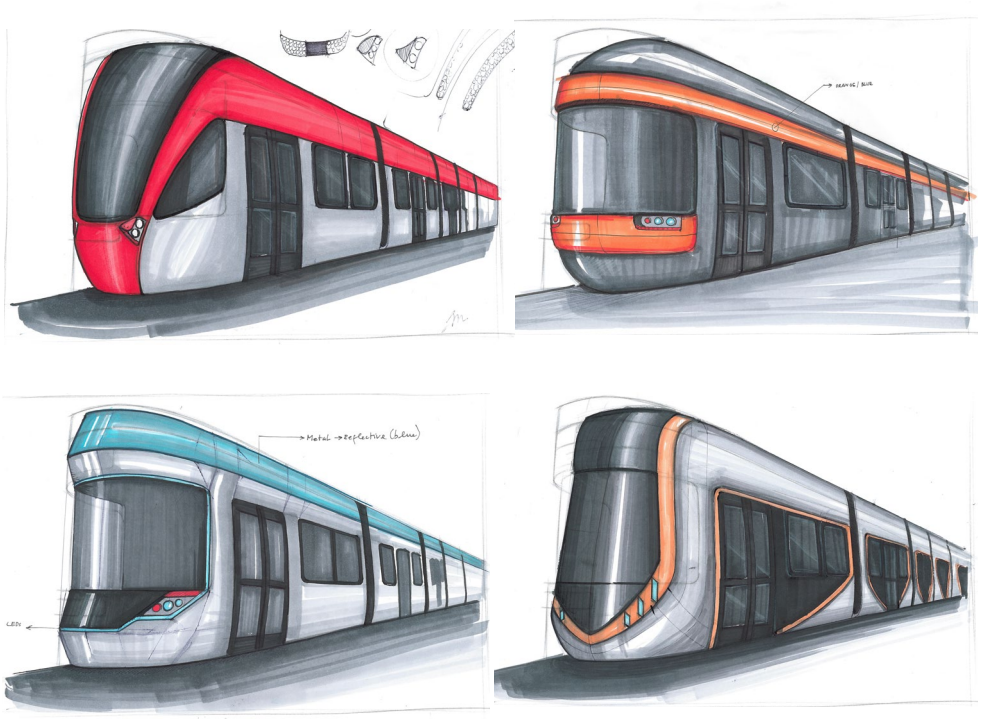
Set of natural trams studies: The trams are inspired in both animals and nature, the lines tend to be more fluid, rounded and organic than geometric. The drawings are made with Copic pens in an A4

2. Modern



Legend 3.2

Set of modern trams studies: The tram lines are geometric, a mix between strait lines and soft curves, the design is minimalist, serious, delicate and appealing. The drawings are made with Copic pens in an A4.



Legend 3.3

Set of classical trams studies: The tram is classic because of its similarity to the brand identity or because of its classic lines. The drawings are made with Copic pens in an A4.

4. 3D modulation exercise

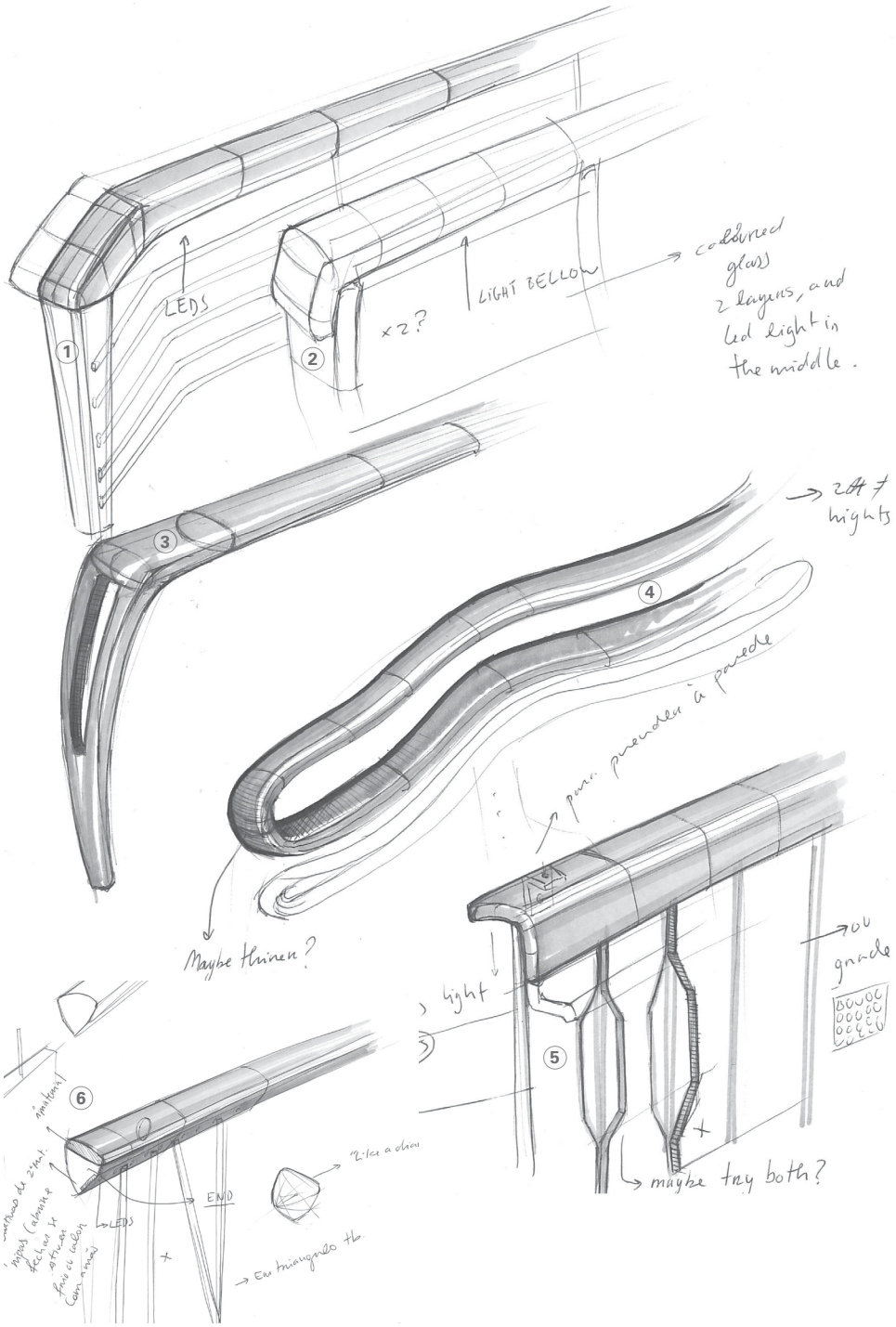
Legend 3.4

Study of one of the models sketched above. It was only a training exercise.

4. Renovation of facilities within the metro and train stations

A. Handrail

Creative research / Sketching of ideas before to arrive to final concept.



Legend 4

Double and simple handrail studies:

Handrail 1: Horizontal metal tubes inspired in Art Deco style, the handrail it thick and made of wood, the lines are angular and strait with rounded corners. (1)

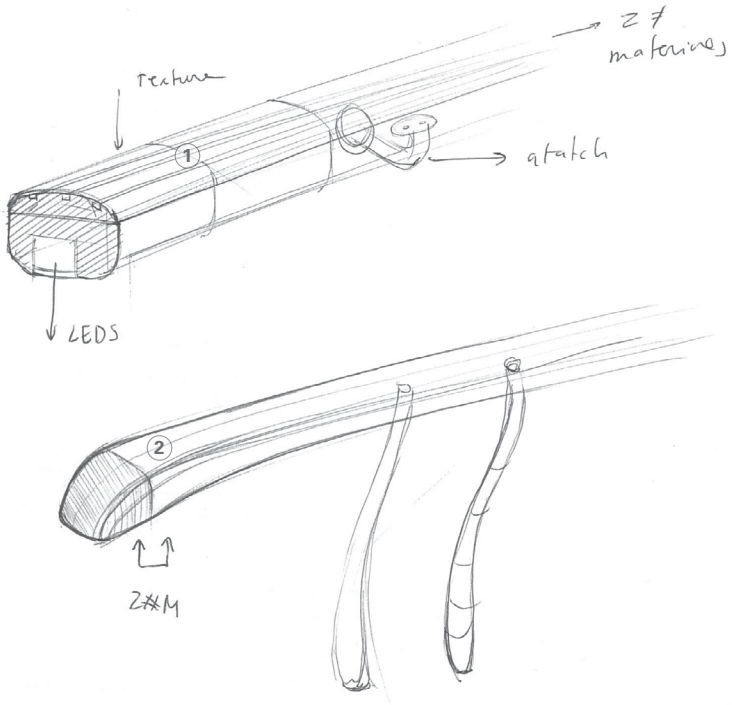
Handrail 2: the handrail is made in wood and the bottom in glass, same concept as the previous one but thinner and the handrail is split in 2 parts. (2)

Handrail 3: Simple handrail with an oval shape that ends like a claw, the claw has a triangular hole. (3)

Handrail 4: Double metal handrail, simple oval cut that goes along a continuous wavy line. (4)

Handrail 5: The top has an "L" shape that is slightly curved at the top to be more comfortable. The bottom is a geometric pattern, a strange repeated "i" forming hexagons in between. (5)

Handrail 6: The top diamond shape is the most similar with the final result. (6)



Legend 4.1

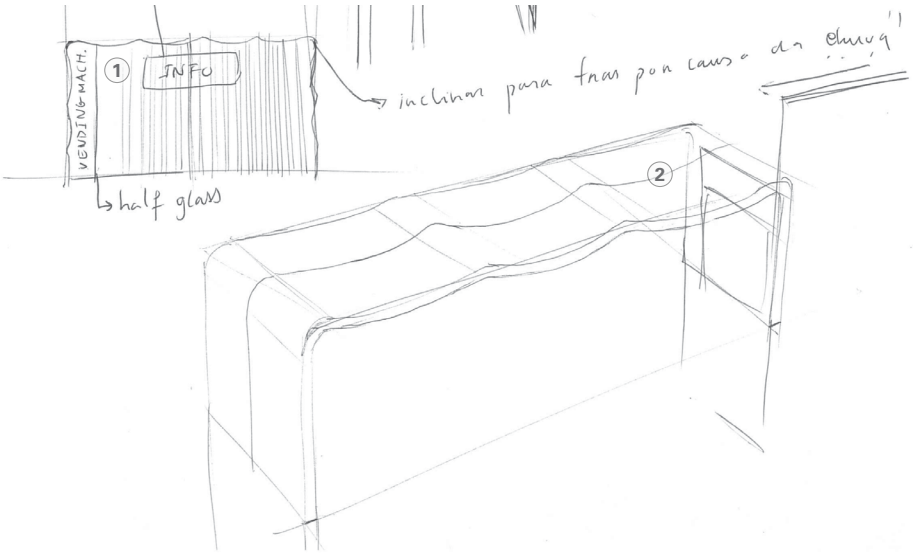
Simple handrail studies:

Handrail 1: Lighted (1) handrail, the top is slightly curved with wood grooves in order to give a censorial (tactile) experience.

Handrail 2: Classical (2) wooden handrail with a curved ending, the thickness becomes slightly bigger in the end. The bottom is more wavy than the top and is also increasing thickness.

B. Waiting areas for train station platforms

Creative research / Sketching of ideas before to arrive to final concept.

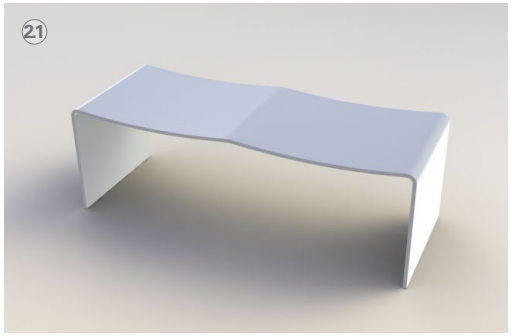


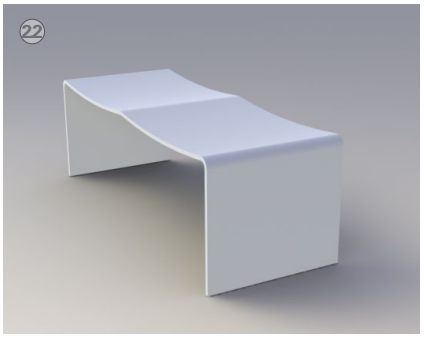
Legend 4.2

Waiting area/shelter studies:

Shelter: Inspired on the (1) bench design below (2).

Bench: This bench was (2) designed for a previous project and reused in this one.

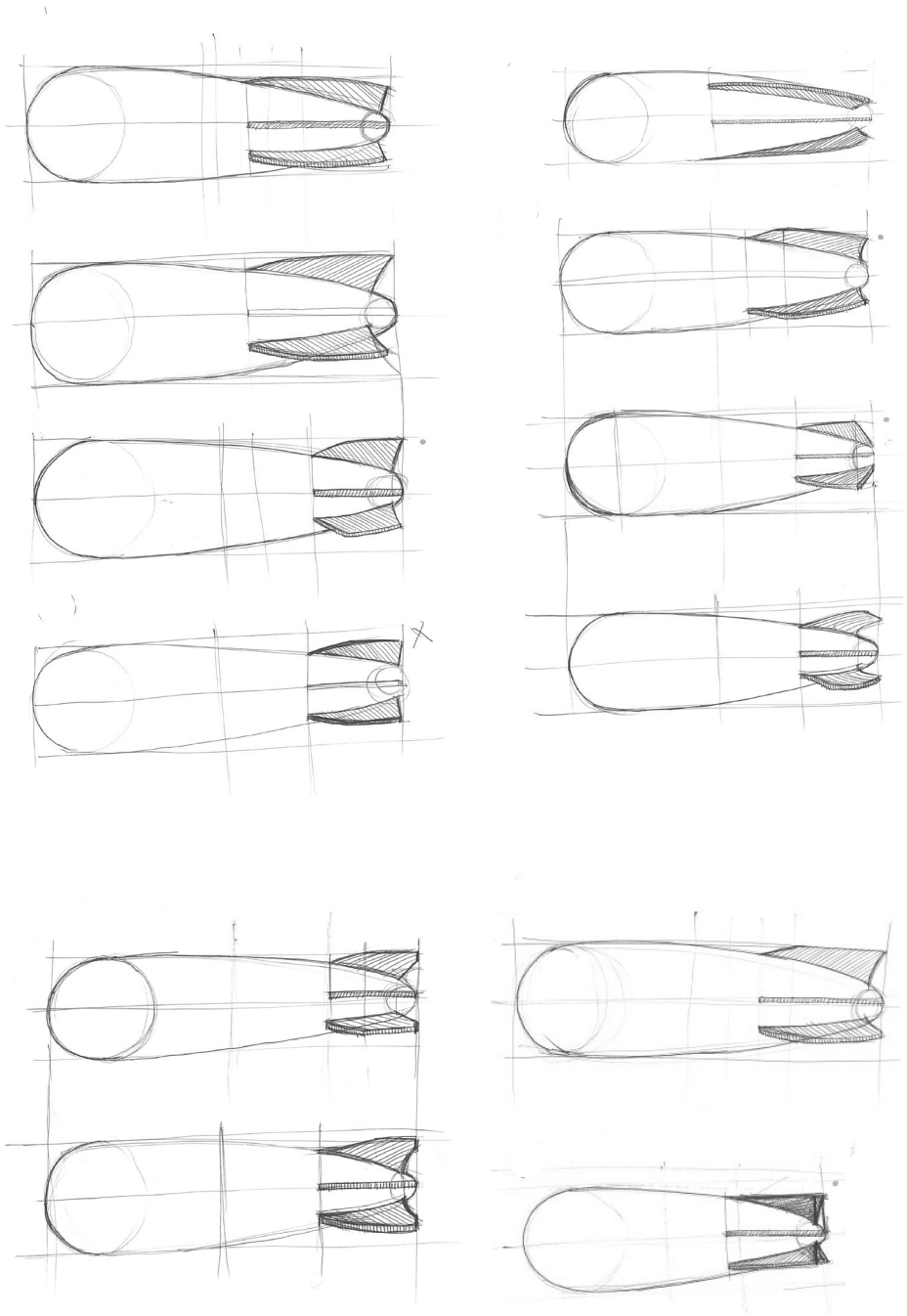




5. *Air balloon*

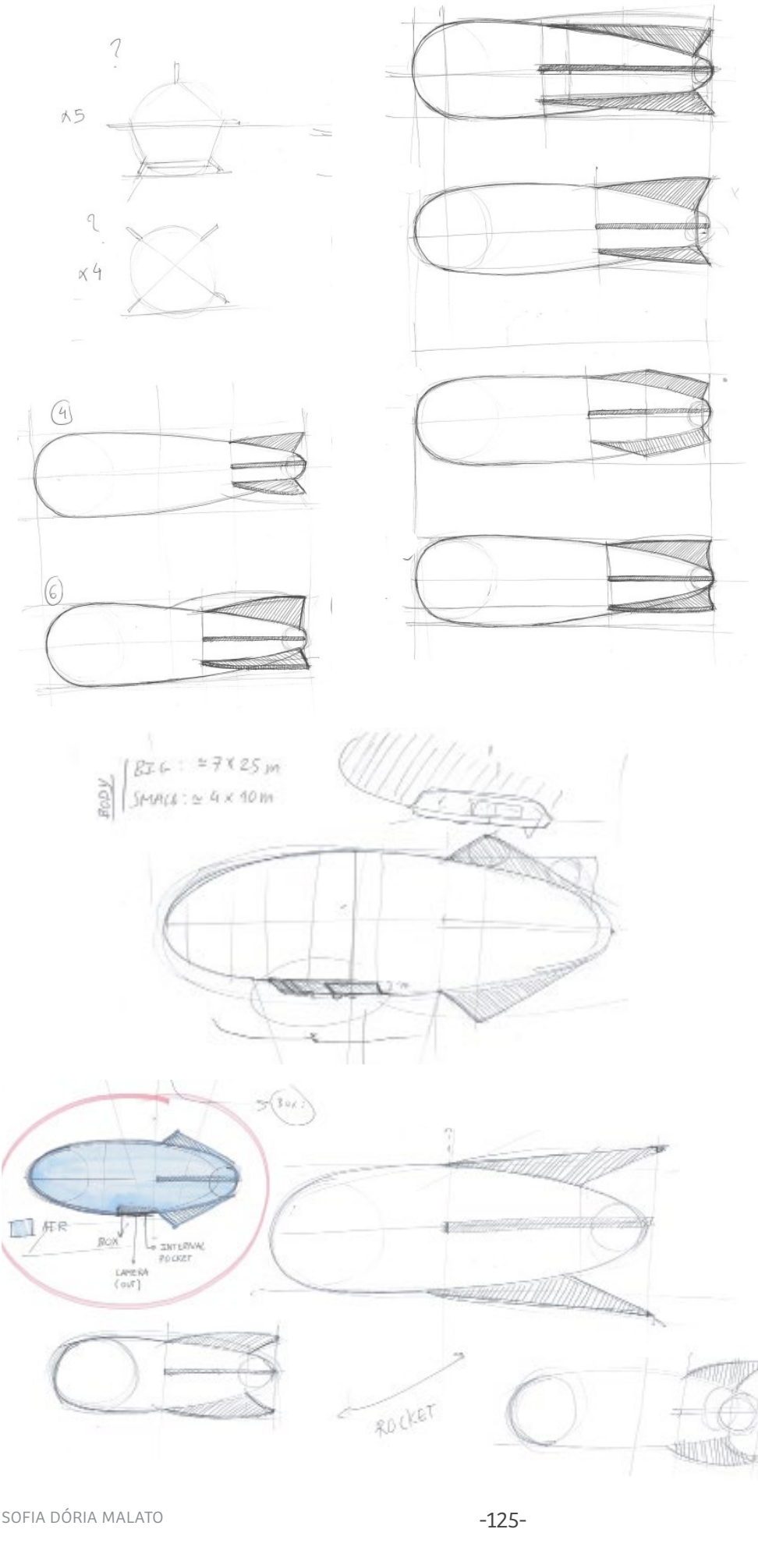
Creative research / Sketching of ideas before to arrive to final concept.

1. Wings



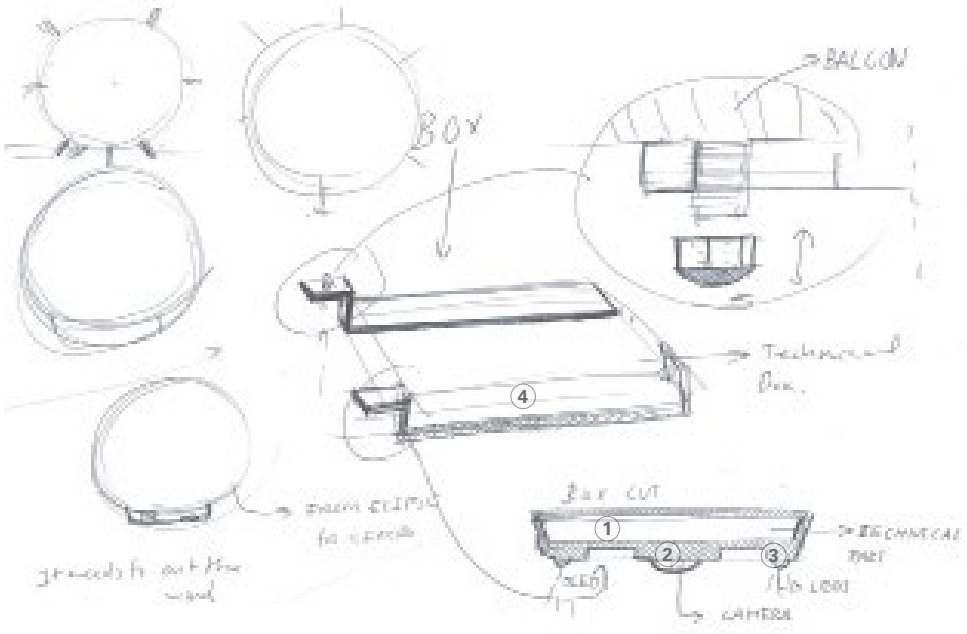
Legend 5

Study of wings, the mid length ones were the most accepted. In order to function well the design must be simple, geometric and aerodynamic.



Legend 5.1

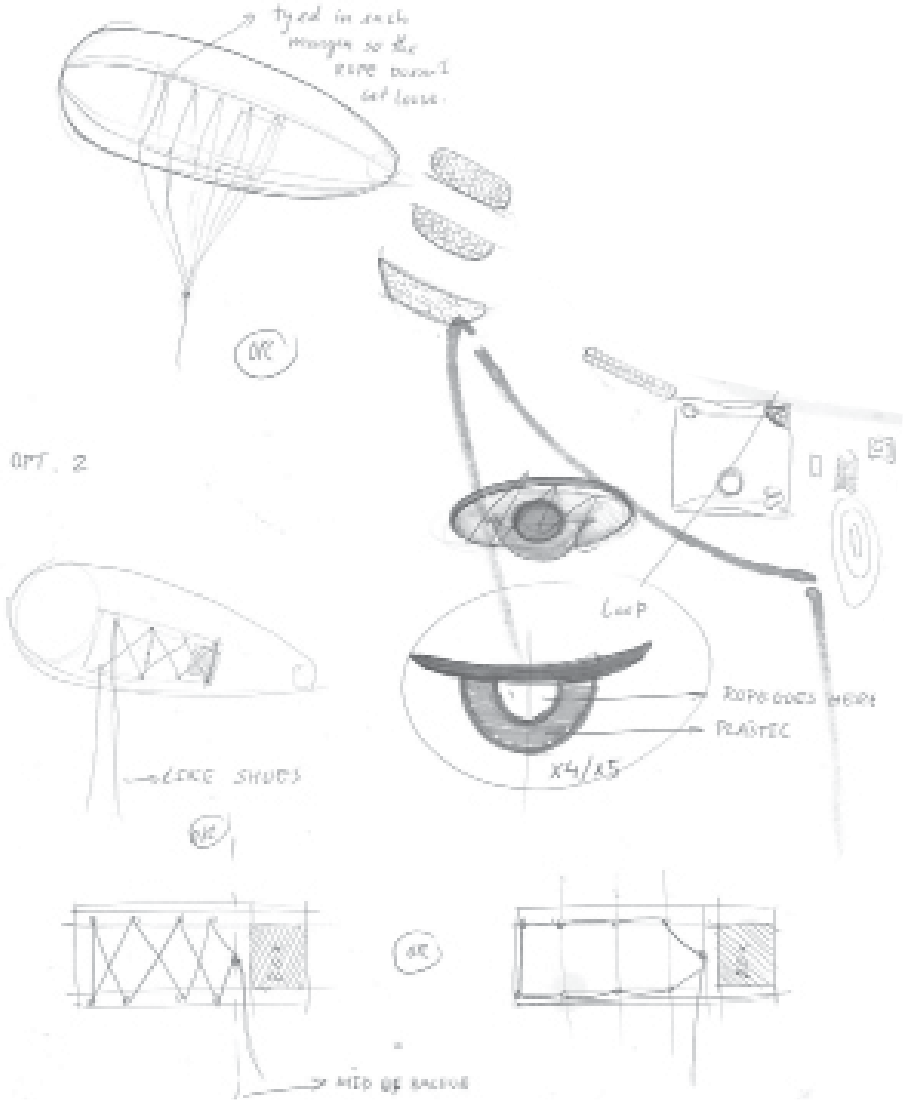
Study of wings



Legend 5.2

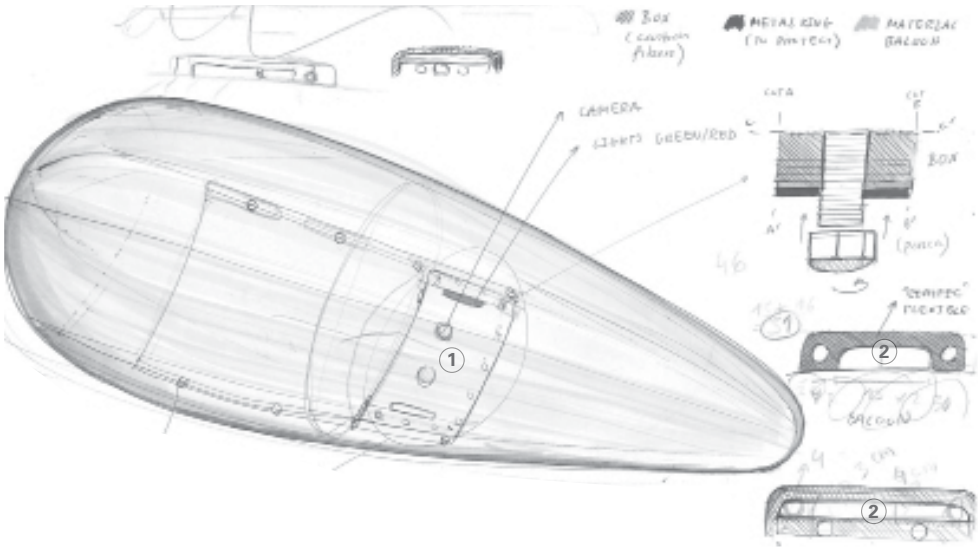
Study of the technical box:

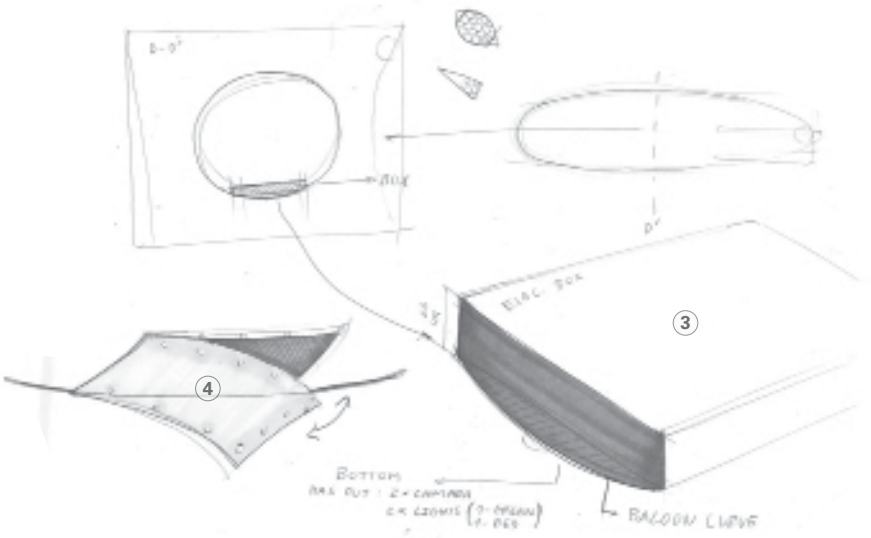
Box (1)
Camera (2)
LEDs (3)
Holding support (4)



Legend 5.3

Study of rope supports and ways of holding it.





Legend 5.4

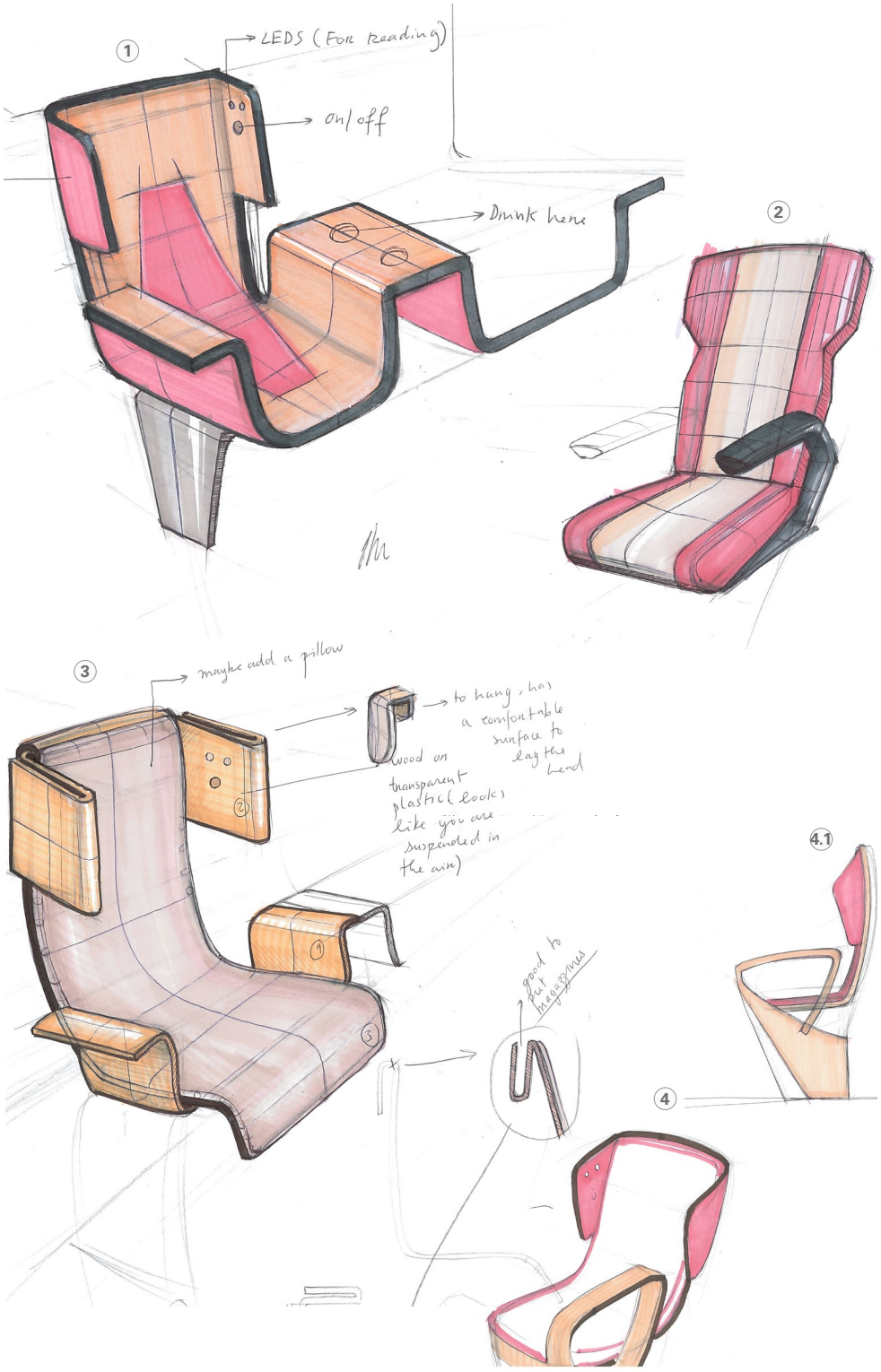
Technical box and handles for hands and ropes:

Technical box in a pocket (1)
Handle for rope and hands (2)
Box (3)
Pocket (4)

6. Interior train design

Creative research / Sketching of ideas before to arrive to final concept.

1. Chairs



Legend 6

Studies of chairs for the train interior:

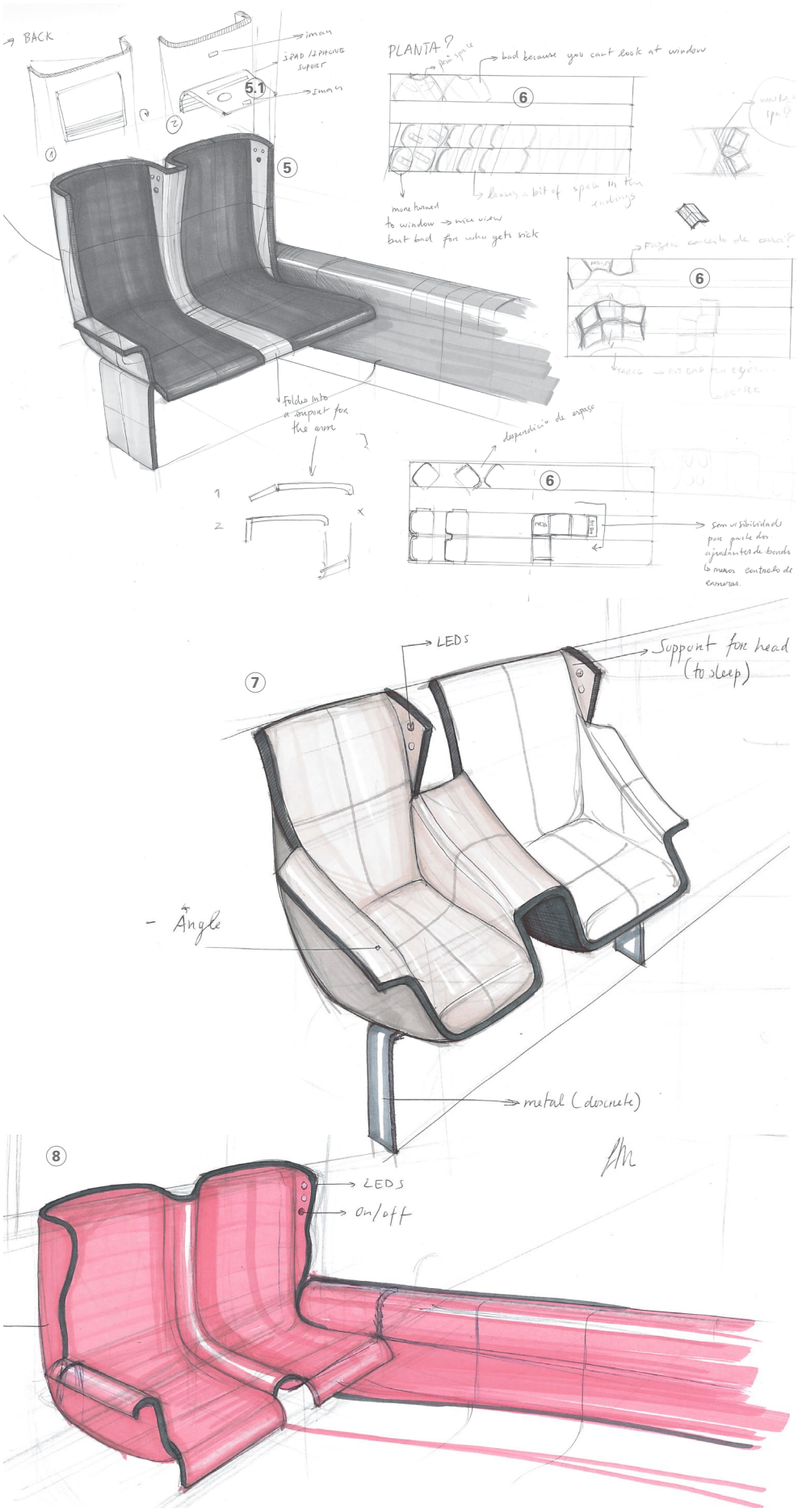
Chair 1: Geometric lines, (1) soft curves, with simple salient lines. The arm rest continues until the window, to blend with the rest of the interior, the 2 seats have a common bigger arm rest with a rest for drinks, the lights for reading are located no the head supports.

Chair 2: Unfinished (2) sketch, old design that doesn't suit the requirements.

Chair 3: Minimalistic (3) design, with 3 simple wavy lines, 1 that supports the back, 1 for the head and 1 for the arms. Again the lights for reading are located in the head rest.

Chair 4: More organic and (4) complex.

Side view of chair number 4 (4.1)



Legend 6.1

Studies of chairs for the train interior:

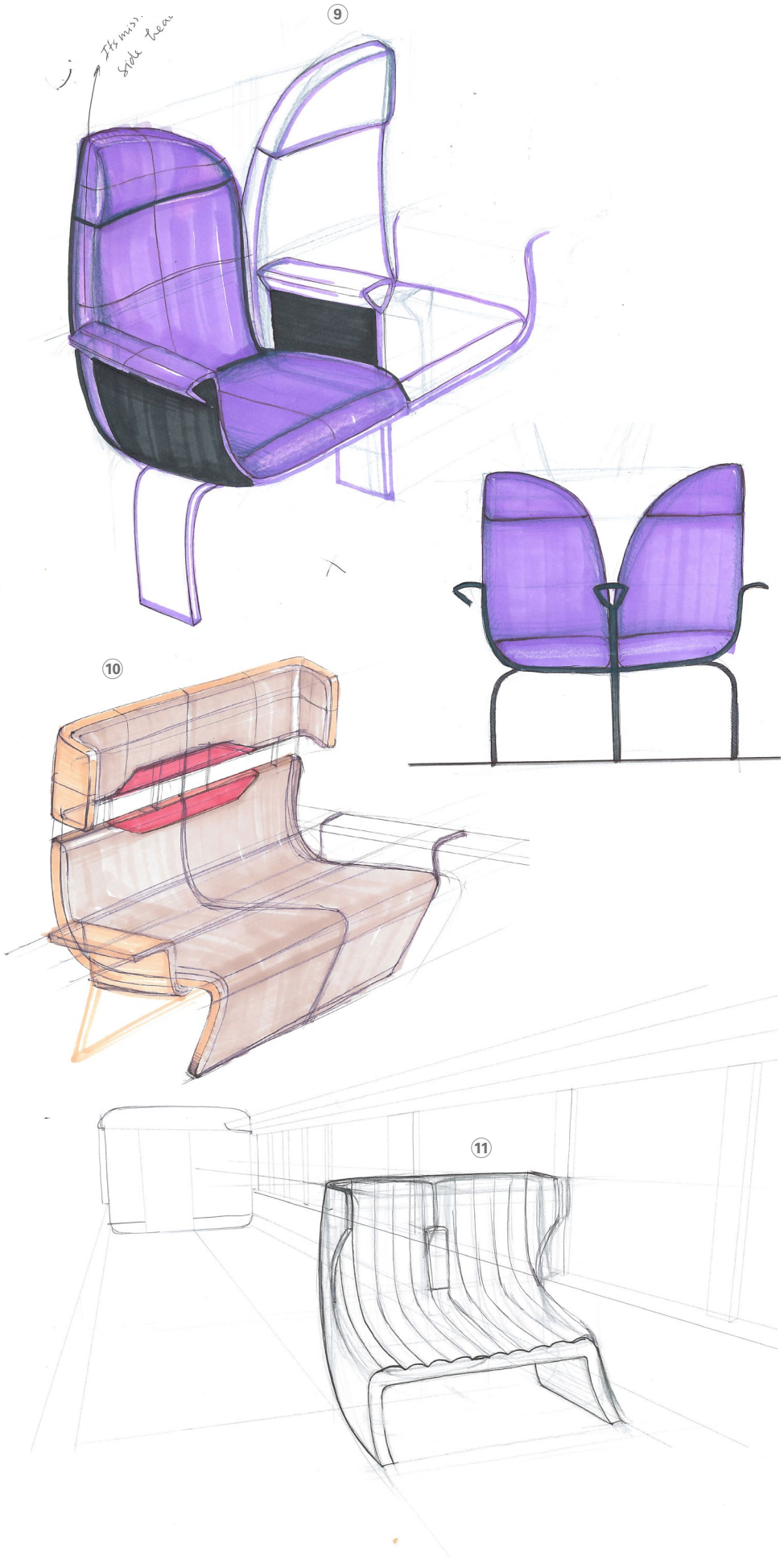
Chair 5: Has similarities (5) with the design 1, but lines are more smooth, less salient, the back support starts slightly curved and ends up strait (legs). On the middle it seems that there is no arm rest, but in fact, the arm rest can be put up and down. The design is geometric and minimal, its simplicity makes it suitable for a variety of environments.

Table: Table for the back (5.1) seats, it is attached by magnets. The wooden table is bendable, and has some cuts in it so that, when opened the table can be safely secured.

Seats distribution: (6) research about unconventional ways of displaying the chairs.

Chair 6: More organic, (7) the chair is not only to seat but also to contemplate. The overall shape is uncommon, but still comfortable and answering to ergonomic requirements.

Chair 7: Similar to the (8) previous design but with slight changes in shape, 1st there is no arm rest in the middle, 2nd the rest for the head has a wavy shape instead of triangular.



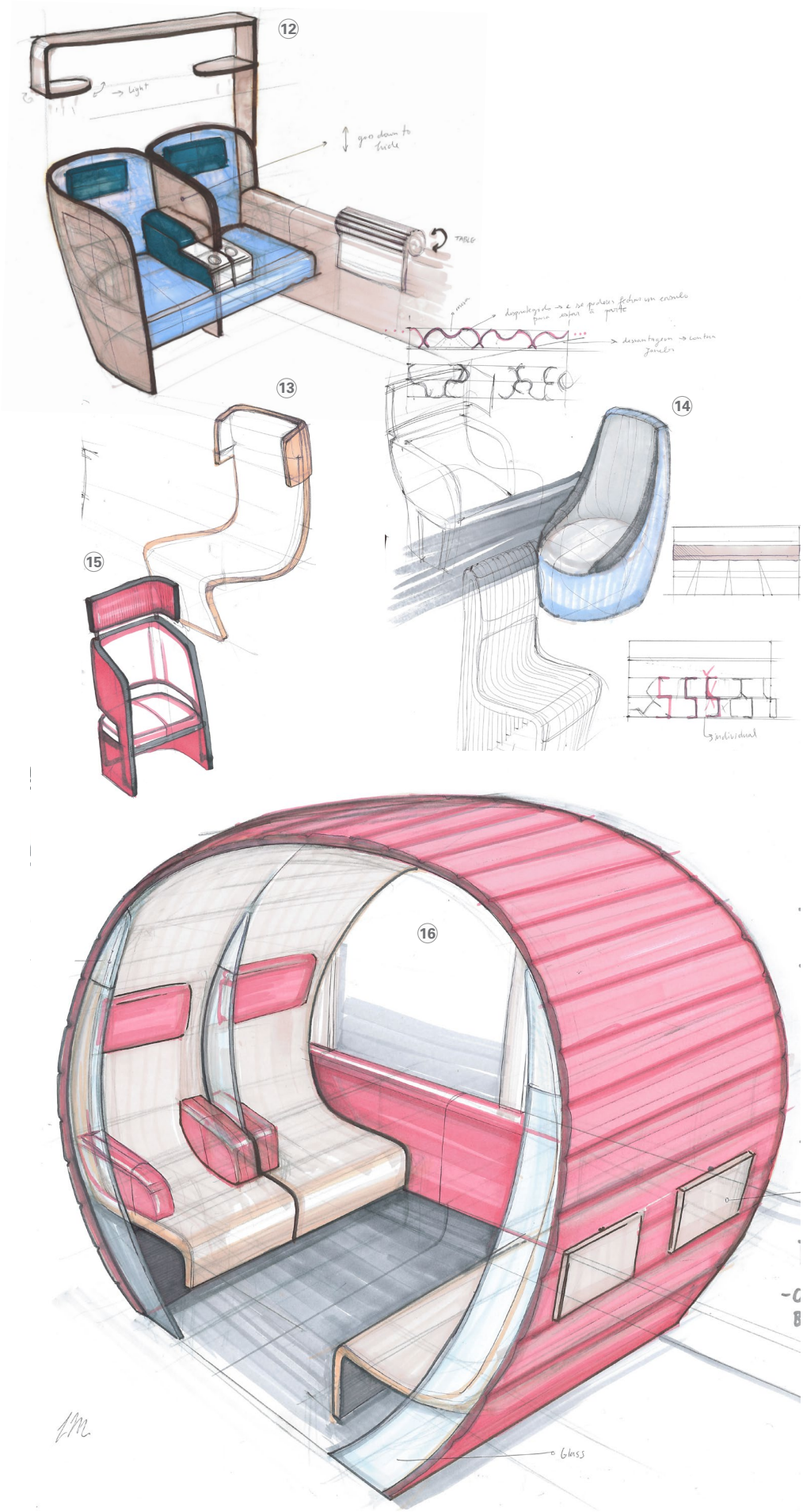
Legend18.2

Studies of chairs for the train interior:

Chair 8: Has an unusual (9) shape for a train chair. In between the 2 chairs, in one side of each, the side has a salient curve making one side of the head support smaller than the other. The overall shape is geometric, the top is triangular, and the rest of the body is composed by curved lines.

Chair 9: A simpler version (10) of the chair number 1, this version has no middle arm rest.

Chair 10: Wavy like a vintage (11) couch, a mix between modern and classic



Legend 6.3

Studies of chairs for the train interior:

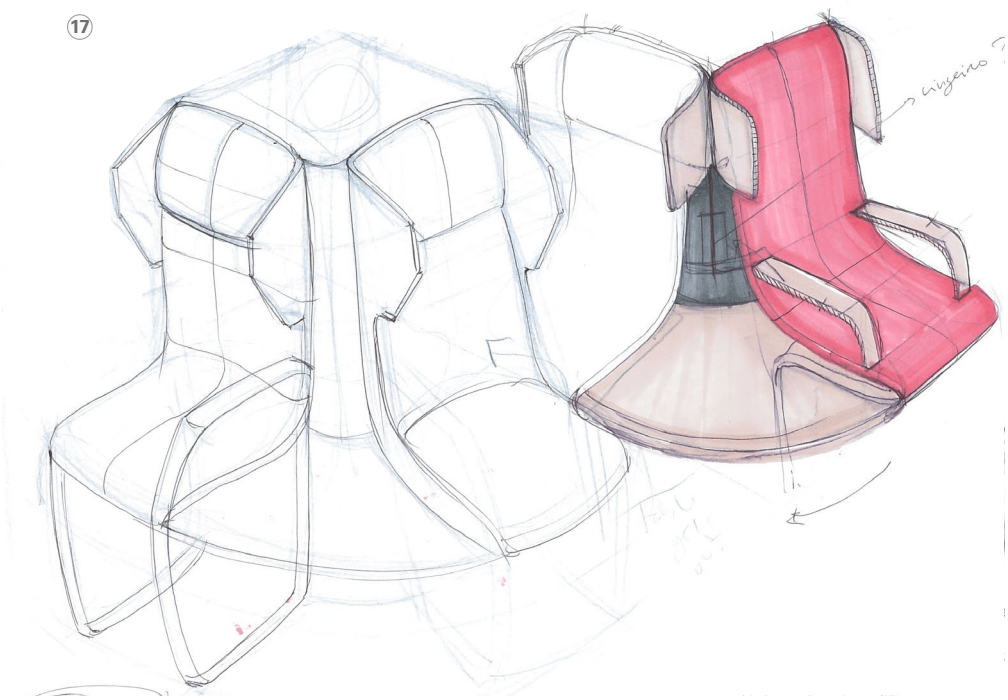
Chair 11, with illumination and table: The chair is designed to give privacy to its user, the lines are a composition of curves shaped like a "U" (has seen in previous drawings), and is inspired in "art dêco style". The lights shape follow the line of the chair. The table works just like the table in the legend 18.1. (12)

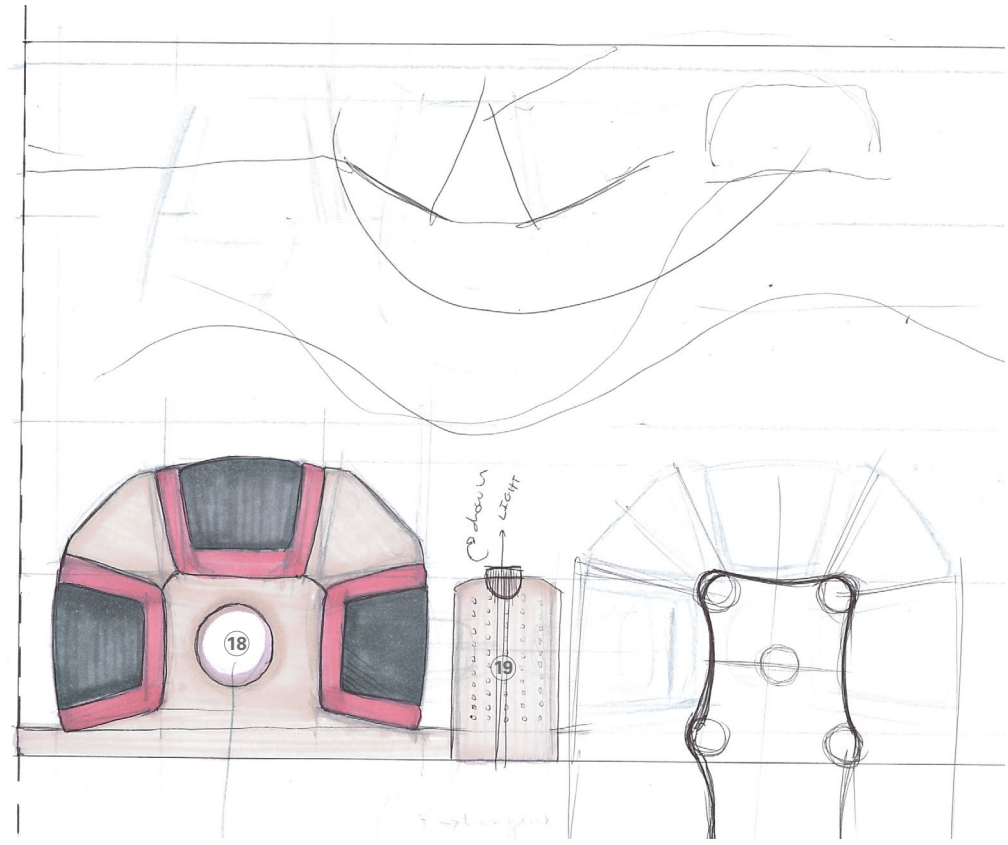
Chair 12: Similar to chair number 3 in the legend 18. (13)

Chair 13: Looks more like a chair for home, not suitable for the project domains. (14)

Chair 14: Window chair, the model has a really strait back, not very ergonomic. (15)

Chair 15: This design works like a "cocoon", its propose is to create a place more private , protective and comfortable, it can be designed only for 2 seats. Luggage could be located on a compartment on the top. The design is simple, clean, a mix between modern and vintage (on the padding). (16)





Legend 6.4

Studies of chairs for the train interior:

Final: This design was the 17 concept chosen by the author to be developed. The idea is to contradict the traditional chair distribution in most of trains existing today. Each set of chairs is grouped in 3, like this, the corridor instead of a straight line will be slightly wavy, the side passengers will be looking at each other, front to front, just like the ones near the window, look to the seat in front of them. The seats are disposed along a curve (a cut circle), luggage can be tidy bellow the chair. The overall shape is simple, very similar with drawing number 3 in the legend 18.

Light: The top (surface in the centre of the set) is a surface composed by LEDs, 18 a soft light intended to create a nice environment.

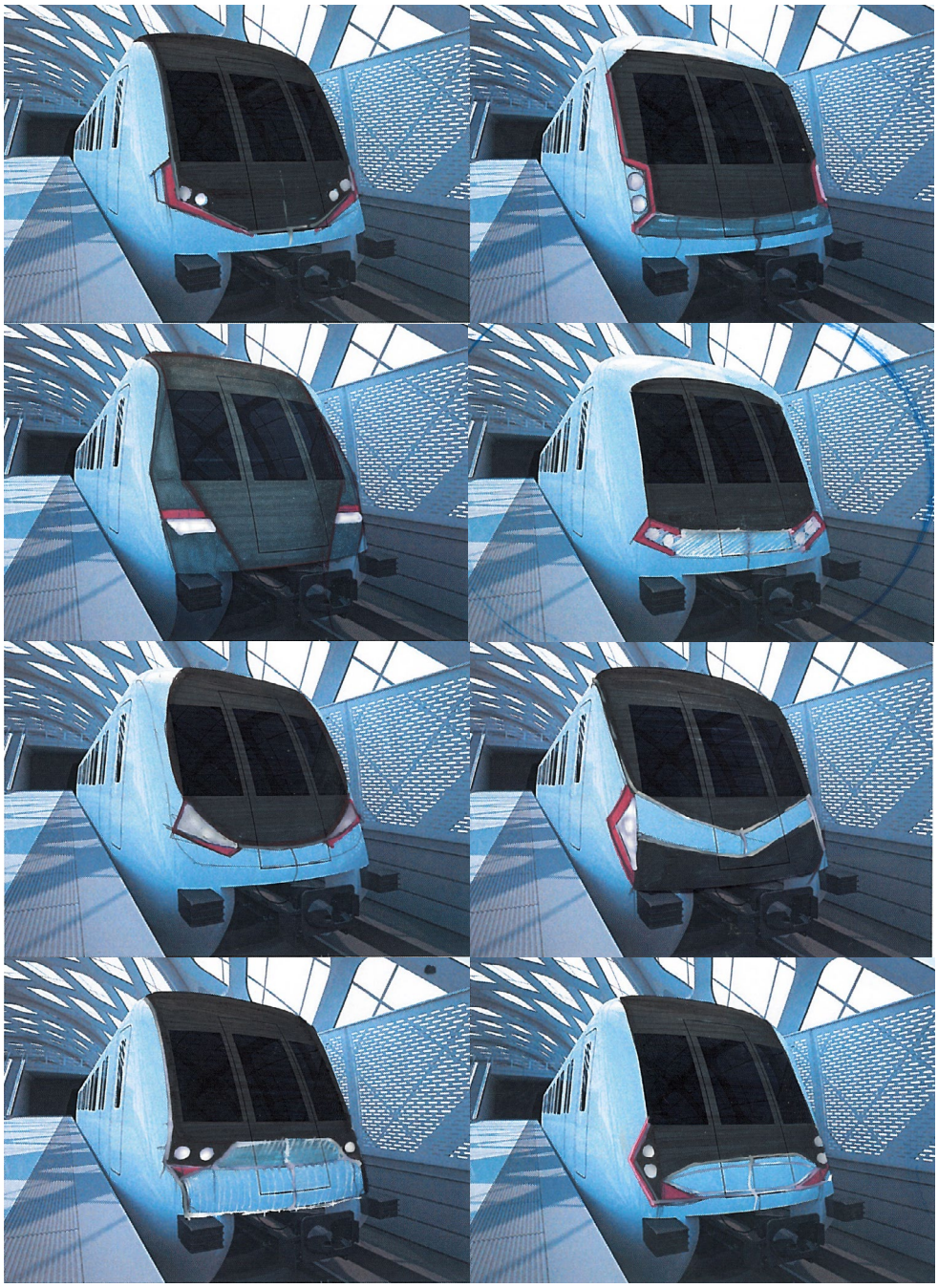
Table: the table has holes on it to help cooling the laptop. 19

7. Metro Layouts

C. Metro 3

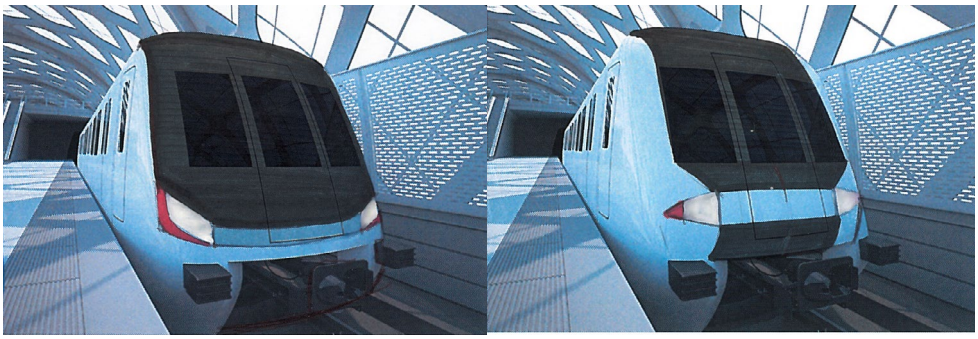
Creative research / Sketching of ideas.

1. Geometric inspiration



Legend 7

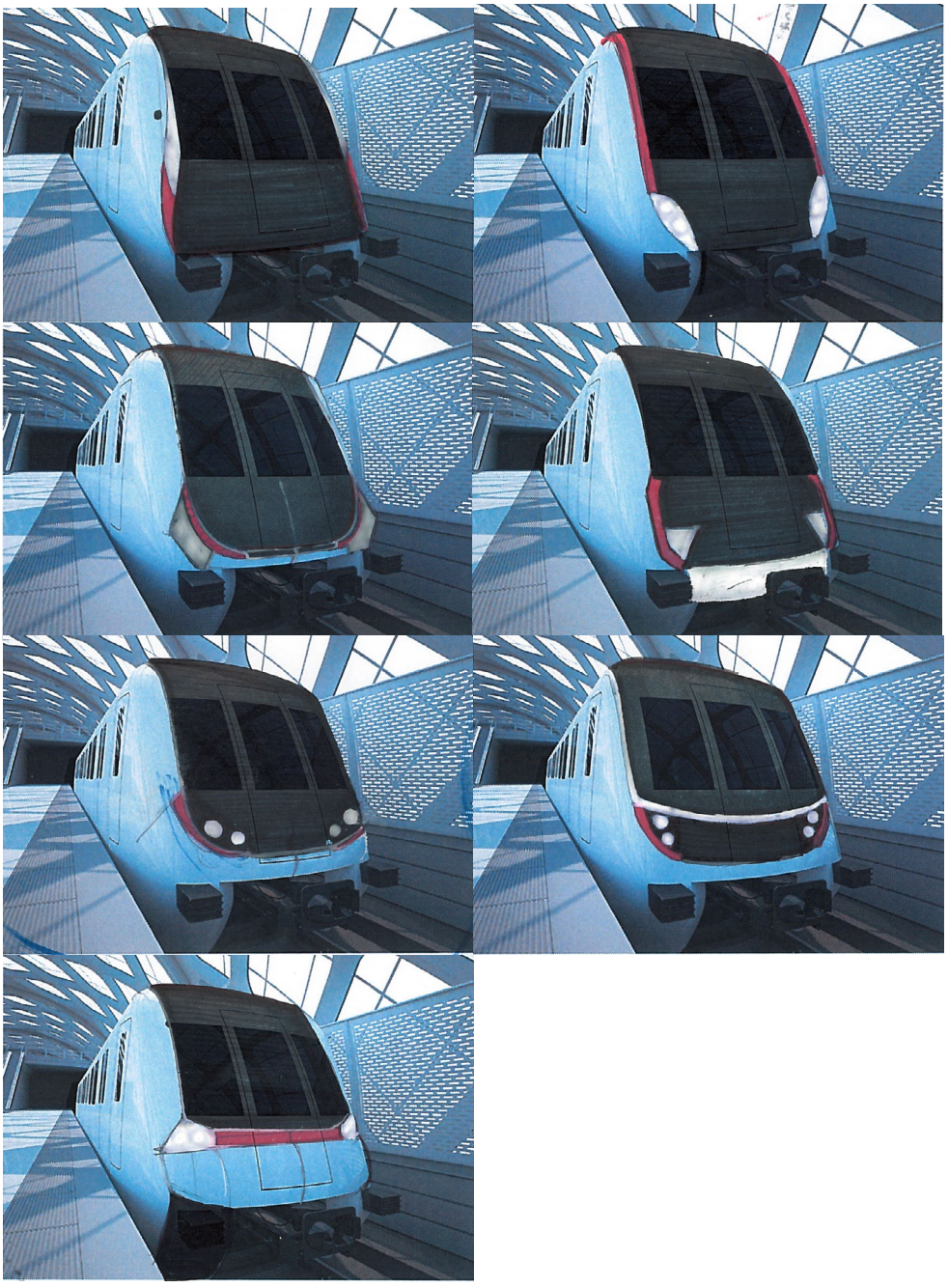
Set of studies of metro fronts for a project in China. Inspired in geometric shapes.



Legend 7.1

Set of studies of metro fronts for a project in China. Inspired in geometric shapes.

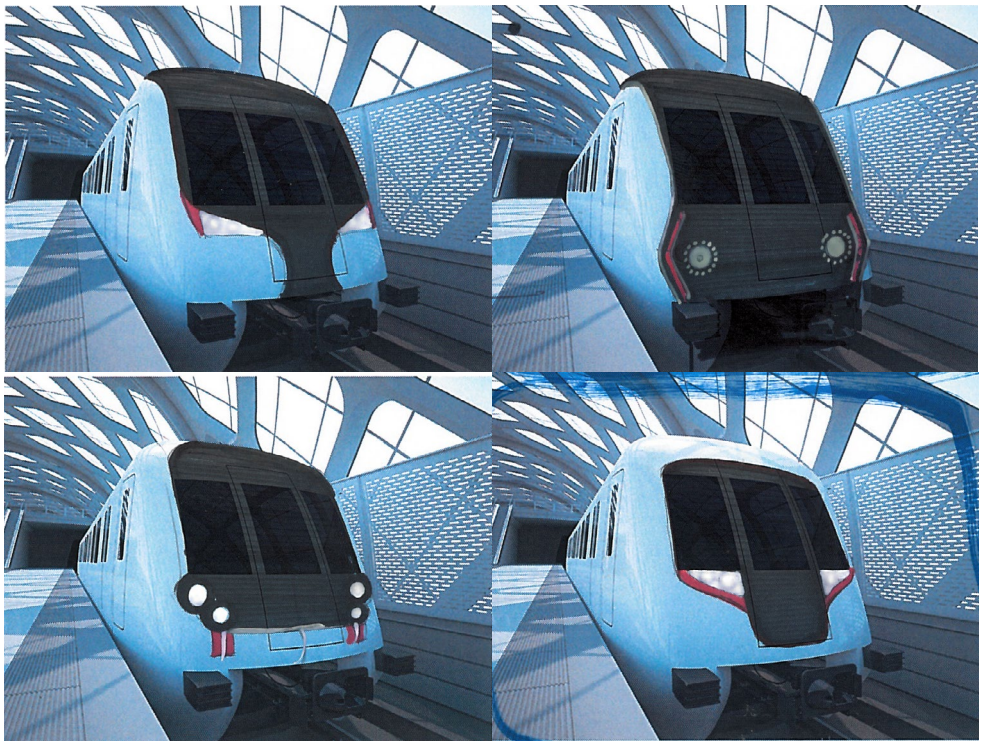
2. Natural/Organic inspiration



Legend 7.2

Set of studies of metro fronts for a project in China. Inspired in natural and organic shapes.

3. Chinese culture inspiration



Legend 7.3

Set of studies of metro fronts for a project in China. Inspired in Chinese culture shapes.